10-3930-639-14+P

TM 10-3930-639-14&P

TECHNICAL MANUAL

OPERATOR'S, ORGANIZATIONAL,
DIRECT SUPPORT AND GENERAL SUPPORT
MAINTENANCE MANUAL
INCLUDING REPAIR PARTS INFORMATION
AND
SUPPLEMENTAL OPERATING, MAINTENANCE
AND REPAIR PARTS INSTRUCTIONS

FOR

FORKLIFT TRUCK, GED, SRT
4,000 LB. CAP
144 INCH LIFT HEIGHT
Model ACC 45 PS
MHE 239
NSN 3930-01-075-4937

READEX FICHE best copy available

HEADQUARTERS, DEPARTMENT OF THE ARMY
MAY 1981

O101.11:

Reproduced from poor document.

⚠ SAFETY

Before operating a lift truck, the operator should be trained and qualified and also must be thoroughly familiar with the operating controls. Any time the operator finds that the truck or the controls are not functioning properly, operation of the truck should be halted and the condition reported to the supervisor.

A. BEFORE STARTING TO OPERATE AND TRAVEL WITH THE LIFT TRUCK

1. The operator must be in the normal operating position (seated and facing forward).
2. Make certain the parking brake is set and the shifting levers are in NEUTRAL before the key switch is turned on.
3. Start the engine and check the functioning of the tilt and lift system, directional and speed levers, inching pedal, horn, steering, brakes, and lights (if so equipped).

B. OPERATING

1. Operation of the truck, or any auxiliary device, must be performed only when the operator is in the normal operating position (seated and facing forward).
2. Load the truck only up to the rated capacity.
3. Operate the truck on authorized ramps only.
4. At no time should anyone stand or pass under the elevated portion of the lift truck, whether loaded or empty.
5. Keep hands, arms, feet, and legs inside the confines of the operator's compartment.
6. Make certain there is sufficient headroom under overhead installations such as lights, pipes, sprinklers, etc.
7. Observe all traffic rules, aisle line markings, stop signs, etc.
8. Stunt driving or horseplay is prohibited.
9. The carrying of any person on the lift truck, other than the authorized operator, is also prohibited.
10. Travel in the direction of the maximum visibility except on grades as indicated in following item 11.
11. All grades should be ascended and descended slowly.
    - a. When ascending or descending a grade, the loaded truck should be operated with the load upgrade.
    - b. An unloaded truck should be operated on all grades with the fork end of the truck downgrade.
    - c. On all grades, the load and/or forks should be raised only as far as necessary to clear the grade and floor surface.
12. Be extremely careful in congested areas and heavy pedestrian traffic; safeguard the pedestrian at all times.
13. Travel at the safest speed that conditions allow, and never more than the authorized plant speed limits. Always reduce speed on wet and slippery floors.
14. Sharp turns at full speed must be avoided. Use extreme caution when turning on an incline.
15. Avoid running over any loose objects in the path of the lift truck.
16. Maintain a safe distance from other vehicles; caution must be used in passing them.
17. While on a ramp, elevated dock or platform, maintain a safe distance from the edge of the ramp, dock or platform.
18. Stop at corners and intersections.
19. Avoid jerky starts and stops; apply the brakes with care and manipulate the load smoothly with caution.
20. When handling off-center loads which cannot be centered, operate the truck with caution. Use extreme care when handling long, high, or wide loads.
21. Only handle loads which are safely arranged.
22. Make certain the forks and/or load are clear of all obstructions before lifting or lowering.
23. All daily checks, maintenance and repair on the lift truck must be performed by qualified and authorized personnel only.

C. LEAVING TRUCK UNATTENDED

When the lift truck is left unattended, the forks must be fully lowered, controls neutralized, parking brake set, and engine stopped (key switch OFF and key removed). The wheels must be blocked whenever the truck is parked on an incline.

A truck is considered unattended whenever the operator leaves the truck and it is out of the operator's view, or when the operator is more than 25 feet (7.6 m) from the truck even though it remains in the operator's view.

When the operator is dismounted and within 25 feet (7.6 m) of the lift truck, but it is still in the operator's view, the forks must be fully lowered, controls neutralized, engine stopped (key switch OFF), and the parking brake set to prevent movement.

D. SAFETY SYMBOLS

The following symbols are used throughout this manual to represent a condition or hazard the operator should be aware of.

⚠ WARNING

Denotes a serious hazard that could cause injury to the operator or other personnel from a particular action or condition.

⚠ CAUTION

Denotes a less serious hazard from an action or condition that could cause damage to the lift truck, its load, or other equipment.

⚠ WARNING

Noise level at operator's ear exceeds 85 dB(A) when lifting load at rated speed and when engine is operated at maximum RPM without load. Hearing protection is required if the truck is to be operated as above by one person continuously for more than fours each day.

The equivalent noise level at operator's ear under the conditions of MIL-STD 268C Track Test is 89 dB(A). The noise level is under 85 dB(A) at a distance from the truck of 35 ft. or greater. The noise level can also be reduced to under 85 dB(A) by operating the truck at approximately 75% of rated speed.

FOREWORD

Allis-Chalmers Lift Trucks are designed, operator-engineered and manufactured to rigid specifications so that your company can achieve the most production for its investment. Correct operation and regular preventive maintenance, coupled with authorized Allis-Chalmers service and parts will ensure long operational life and continued top performance of your lift truck. This Operator's Manual is your guide to proper operation and service intervals. By using this manual, veteran operators can gain additional information on techniques, while operators with little or no experience can learn proper operation in less time and with less chance of an accident.

INTENDED USE

A lift truck is a mobile, self propelled machine intended to lift, stack and carry material within its rated capacity in and around plants, warehouses, yards, loading platforms, docks, railroad cars and highway trailers over paved and well graded, semiprepared surfaces for short distances. It is usually associated with manufacturing or warehousing and is not intended for such uses as earth moving, snow removal or over the road hauling. Any unintended use may seriously affect its operational safety, reliability and longevity.

OPERATION REQUIREMENTS FOR STOCKING UNITS FOR EXTENDED PERIODS.

IT IS REQUIRED THAT AT INTERVALS OF AT LEAST EVERY 30 DAYS, THE UNIT IS TO BE STARTED, BROUGHT UP TO OPERATING TEMPERATURES, AND ALL OPERTING FUNCTIONS PERFORMED.

WARRANTY

WHEN A WARRANTY CIRCUMSTANCE ARISES, CONTACT ALLIS-CHALMERS SERVICE ADMINISTRATION (312/747-5151 Ext. 377) INFORMING MODEL, SERIAL NUMBER, CONTRACT NUMBER RELATING TO THE PARTICULAR UNIT, AND A SUMMARY AS TO THE NATURE OF THE PROBLEM.

This manual contains copyright material.
Published with permission of Allis Chalmers, Cicero, Illinois.

TM 10-3930-639-14&P

TECHNICAL MANUAL
No. 10-3930-639-14&P

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC, *1 May 1981*

OPERATOR'S, ORGANIZATIONAL, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL (INCLUDING REPAIR PARTS INFORMATION AND SUPPLEMENTAL MAINTENANCE AND REPAIR PARTS INSTRUCTIONS)

FOR

TRUCK, FORK LIFT, SOLID RUBBER TIRE: GASOLINE ENGINE DRIVEN

4,000 LB CAPACITY

MODEL ACC 45 PS

144 INCH LIFT HEIGHT

NSN 3930-01-075-4937

REPORTING OF ERRORS

You can improve this manual be recommending improvements using DA Form 2028 (Recommended Changes to Publications and Blank Forms) or DA Form 2028-2 located in the back of this manual and mail the form direct to Commander, US Army Tank-Automotive Materiel Readiness Command, ATTN: DRSTA-MBS, Warren, MI 48090. A reply will be furnished direct to you.

SECTION I OPERATING INSTRUCTIONS
II MAINTENANCE INSTRUCTIONS
III REPAIR INSTRUCTIONS
IV PARTS LIST
V SUPPLEMENTAL OPERATING, MAINTENANCE AND REPAIR PARTS INSTRUCTIONS

AUTHENTICATION STATEMENT

This technical manual is an authentication of the manufacturer's commercial literature and does not conform with the format and content specified in AR 310-3, Military Publications. This technical manual does, however, contain available information that is essentital to the operation and maintenance of the equipment.

SECTION I

OPERATING INSTRUCTIONS

STANDARD VALUES						
CAPSCREW SIZE	POUNDS FOOT					
	GRADE 2		GRADE 5		GRADE 8	
	NC	NF	NC	NF	NC	NF
1/4"	5-7	6-8	9-11	11-13	12-14	14-16
5/16"	11-13	13-15	18-20	21-23	25-27	28-30
3/8"	18-21	19-22	28-33	30-35	41-46	43-48
7/16"	30-33	32-35	44-49	50-55	69-74	72-77
1/2"	45-50	45-50	68-73	68-73	95-105	95-105
9/16"	60-65	60-65	95-105	95-105	130-140	130-140
5/8"	75-85	75-85	125-135	125-135	170-190	170-190
3/4"	125-135	125-135	210-230	210-230	290-310	290-310
7/8"	105-115	105-115	290-310	290-310	450-500	450-500
1"	140-150	450-475	380-410		600-630	

SPECIAL VALUES		
DESCRIPTION	THREAD SIZE	TORQUE LBS. FT.
Cylinder Head Mounting	1/2 - 13	110-120
Cylinder Head Mounting	1/2 - 13	110-120
Cylinder Head Lifting	1/2 - 20	110-120
Thermostat Housing and Cylinder Head	1/2 - 13	110-120
Water Outlet	3/8 - 16	18-21
Manifold, Intake and Exhaust	7/16 - 20	32-35
Main Bearing Mounting	9/16 - 12	120-130
Connecting Rod	3/8 - 24	45-50
Crankshaft Pulley Retaining	1 - 16	240-260
Oil Pressure Regulating Screw	3/4 - 16	125-135
Lube Oil Filter Mounting	1/2 - 13	45-50
Spark Plugs	14 MM	25-30

FOREWORD

Allis-Chalmers Lift Trucks are designed, operator-engineered and manufactured to rigid specifications so that your company can achieve the most production for its investment. Correct operation and regular preventive maintenance, coupled with authorized Allis-Chalmers service and parts will ensure long operational life and continued top performance of your lift truck. This Operator's Manual is your guide to proper operation and service intervals. By using this manual, veteran operators can gain additional information on techniques, while operators with little or no experience can learn proper operation in less time and with less chance of an accident.

SAFETY

After the operator has thoroughly read and understands this manual, with a few hours of practice he should be able to effectively operate a lift truck. The GOOD operator not only understands and follows the procedures written in this manual but is one who is SAFETY conscious. Several safety tips and procedures are incorporated throughout this manual. Though these tips and procedures are illustrated through a cartoon media, they are not to be taken lightly. The cartoons have their intent and purpose for the manual. That is, to help make a GOOD operator.

If you have any questions regarding the operation, specifications, maintenance or service of your lift truck, contact your local Allis-Chalmers dealer.

INDEX

TOPIC	TOPIC TITLE	PAGE
1	GENERAL DESCRIPTION	1-1
2	PREPARING A NEW TRUCK FOR SERVICE	1-3
	A. INSPECTION UPON DELIVERY	
	B. ENGINE OIL	
	C. COOLING SYSTEM	
	D. FUEL TANK	
	E. LUBRICATION	
	F. BATTERY	
	G. POWER SHIFT TRANSMISSION	
	H. DIFFERENTIAL	
	I. HYDRAULIC SYSTEM	
	J. BRAKE MASTER CYLINDER	
	K. AIR CLEANER	
3	OPERATING CONTROLS	1-4
	A. STEERING WHEEL	
	B. FORWARD/REVERSE LEVER - POWER SHIFT	
	C. LIFT AND TILT CONTROLS	
	D. PARKING BRAKE LEVER	
	E. INCHING CONTROL - POWER SHIFT	
	F. BRAKE PEDAL	
	G. ACCELERATOR PEDAL	
	H. INSTRUMENT PANEL	
	1. Oil Pressure Gauge	
	2. Ammeter	
	3. Engine Coolant Temperature Gauge	
	4. Fuel Gauge	
	5. Hourmeter	
	6. Ignition Switch	
	7. Choke Control	
	8. Transmission Temperature Gauge	
	I. OPERATOR'S SEAT ADJUSTMENT	
4	OPERATION OF LIFT TRUCK . . .	1-7
	A. STARTING THE ENGINE	
	B. SHIFTING OPERATION - POWER SHIFT	
	C. LIFTING AND LOWERING OPERATIONS	
	D. TILTING OPERATIONS	
	E. SIDE SHIFTER OPERATION	
	F. FORK ADJUSTMENT	
	G. LOAD HANDLING PROCEDURES	
	1. Lifting a Palletized Load	
	2. Traveling	
	3. Positioning, Stacking, and Unloading	
	4. Unpalletized Loads	
	H. STOPPING THE TRUCK	
	I. DAILY CHECK LIST	
	J. DAILY CHECK LIST EXPLANATION	
5	BATTERY	1-14
6	LUBRICANT SPECIFICATIONS . .	1-15
	A. ENGINE LUBRICATION OIL	
	B. HYDRAULIC SYSTEM OIL	
	C. POWER SHIFT TRANSMISSION OIL	
	D. DIFFERENTIAL LUBRICANT	
	E. BULL GEAR AND JACKSHAFT PINION	
	F. WHEEL BEARINGS AND JACKSHAFT BEARINGS	
	G. PRESSURE GUN FITTINGS	
	H. OIL CAN POINTS	
	I. BRAKE MASTER CYLINDER	
	J. MASTS	
7	LUBRICATION AND SERVICE . .	1-17
	A. 8-HOUR SERVICE	
	B. 50-HOUR SERVICE	
	C. 100-HOUR SERVICE	
	D. 200-HOUR SERVICE	
	E. 500-HOUR SERVICE	
	F. 1000-HOUR SERVICE	

TOPIC 1. GENERAL DESCRIPTION

Allis-Chalmers Lift Trucks are designed to function in a variety of heavy-duty industrial applications. Power requirements are met by a gasoline, 4- or 6- cylinder, 4-stroke cycle, naturally aspirated engine. Engine cooling is accomplished by a belt-driven centrifugal pump that forces coolant through the head, block and fin-type radiator. The engines are pressure lubricated to the rocker arms, main bearings, and connecting rods by a gear type oil pump driven by the camshaft. The oil is cleaned by a replaceable oil filter. An oil filler cap is located on a filler tube assembly on the side of the cylinder block or on the valve cover. Oil level is easily checked by a conveniently located dipstick.

The power shift transmission consists of three major components - a constant-mesh transmission, a hydraulically actuated clutch pack, and a torque converter. A single-lever shift control on the right side of the steering column controls the direction of travel through a control valve mounted on the transmission housing.

The drive unit incorporates a double-reduction gear train using the latest advancements in gear design. All parts of the unit are bearing mounted for the greatest possible efficiency and quietness. The first reduction is through a heavy-duty spiral bevel ring gear and pinion drive gear. Final reduction is obtained through a pinion (jackshaft) and internal tooth gear (bull gear). This method greatly reduces torque stress on the axle shaft.

The truck is equipped with hydraulic brakes designed for long life and minimum maintenance. They have a large braking area and give smooth braking and positive control under all operating conditions. Brakes are located in each drive wheel. The parking brake is mounted on the differential case, and the brake drum is mounted on the differential drive pinion flange. The parking brake handle is located within easy reach of the operator's left hand.

A power steering control unit located at the lower end of the steering column diverts hydraulic oil, under pressure, to the appropriate power steering port. Hydraulic oil lines connect the steering unit to the power steering cylinder to give the lift truck a full power steering system. The power steering system provides maximum control of the lift truck with minimum steering effort.

The lift assembly utilizes special rolled steel channel sections, and/or "I" beams, and cross braces, all welded to form a rigid permanent structure. Due to construction features of the inner mast and carriage rollers, sliding friction is virtually eliminated. Two independent lift chains are used for safety; each has sufficient strength to safely handle a full load. A special seat at the bottom of the mast permits self-alignment of the lift cylinder within the mast channels, thus reducing off center stresses.

The heavy-duty welded steel fork carriage provides the ultimate in strength and visibility. The forks are identical and interchangeable. Notches spaced along the upper edge of the carriage act in conjunction with latches on the forks to position and secure them to the carriage.

Hydraulic pressure, used to actuate the cylinders or accessory equipment, is supplied by a positive-displacement gear pump coupled

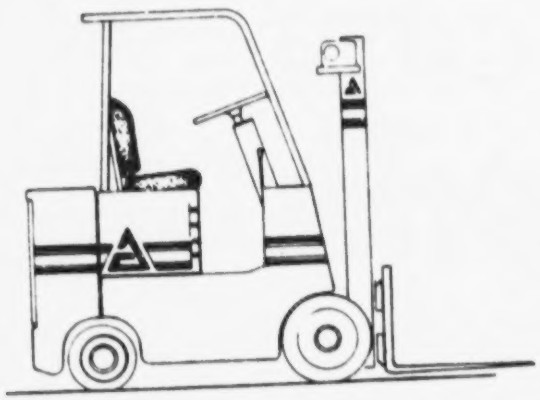


Figure 1-1. Lift Truck - Typical

directly to the engine crankshaft. A control valve with handles conveniently located to the right of the operator actuates the lift and tilt cylinders or attachments. The hydrualic oil reservoir has more than ample capacity for normal displacement needs.

Current advancements in stress analysis and design have made possible a lift truck frame that is lighter and less bulky, yet stronger than the conventional box-type frame. Counterweights, cowls, and fenders are easily removed, thereby reducing downtime for parts removal, service, and overhaul.

The instrument panel, located directly in front of the driver, has a complete set of electrical gauges including a gas gauge, oil pressure gauge, engine coolant temperature gauge, ammeter, and a direct-reading engine hourmeter. The ignition starting switch and choke control are also located on the panel.

All models have a 12 volt electrical system consisting of one 12 volt battery. A heavy-duty alternator, voltage regulator, starting motor, solenoid switch, and horn are the other major components of the electrical system. The electrical gauges and horn are protected by fuses located on the right underside of the instrument panel.

The light switch is located on the right side of the instrument panel. Pull out on the light switch to turn on lights. Push in on light switch to turn off lights.

TOPIC 2. PREPARING NEW TRUCK FOR SERVICE

Your Allis-Chalmers lift truck is generally shipped with the fuel system drained, the cooling system filled with antifreeze, the crankcase filled to correct oil level, and the truck completely lubricated. Because shipping procedures may vary, it is imperative that the following checks be performed before placing the truck in service.

A. INSPECT UPON DELIVERY

For your protection, make a thorough inspection of the vehicle immediately upon delivery. In case of damage or any shortage, notify transit agent at once and have delivering carrier make a notation on the freight bill of lading.

B. ENGINE OIL

Check oil level in crankcase. Withdraw dipstick and wipe clean; reinsert all the way and then remove it for a true reading.

CAUTION: Do not check oil level while engine is running.

NOTE: All units are shipped with a preservative-type oil in the engine crankcase. This oil should be drained immediately and replaced with the proper oil. Refer to LUBRICATION SPECIFICATIONS for correct oil to use.

C. COOLING SYSTEM

Make certain the cooling system is filled with clean fresh water, or permanent type antifreeze.

All units are shipped from the factory with the cooling system protected to -30°F, or lower, with permanent antifreeze.

D. FUEL TANK

Check fuel gauge on instrument panel and make sure the tank is full. If it is not, fill the tank with the proper fuel. Use regular grade gasoline that has a minimum octane rating of 89. The fuel tank filler is equipped with a protecto-seal cap to guard against fire hazards, theft, and tampering.

E. LUBRICATION

Be sure truck has been thoroughly lubricated. Check all lubrication points as shown in the LURRICATION AND SERVICE GUIDE.

F. BATTERY

A 12-volt battery is located in a swing-out tray below the operator's seat inside the right side panel. Keep cells filled to the bottom of the filler holes with clean distilled water.

G. POWER SHIFT TRANSMISSION

Remove floor plate and with the parking brake set and transmission in NEUTRAL, start and run engine for a few minutes until transmission fluid operating temperature is obtained. Stop engine and immediately check transmission fluid level with the dipstick.

H. DIFFERENTIAL

With vehicle on a level surface, remove plug from front of axle housing. Oil should be level with lower edge of plug hole.

I. HYDRAULIC SYSTEM

With the truck on a level surface, lift cylinder vertical, and with lift plunger retracted, turn off the engine and check oil level in the hydraulic reservoir. Oil should be to the level shown on the dipstick. The dipstick is located at the top of the reservoir, inside the right hand panel.

J. BRAKE MASTER CYLINDER

The brake master cylinder is located under the floor plate on the right side of the truck. It should be filled to 3/8" from bottom of filler neck.

K. AIR CLEANER

The air cleaner, which is mounted inside the engine compartment, is a dry element type cleaner with replaceable cartridge. Check tightness of all connections.

TOPIC 3. OPERATING CONTROLS

All operators should learn the locations and functions of the various instruments and controls before attempting to operate the vehicle. See figure 3-1 for location of the controls described in this Topic.

A. STEERING WHEEL

The steering wheel is operated in the conventional manner, that is, when the wheel is turned right the truck will turn to the right; when the wheel is turned left, the truck will turn to the left. The steer wheels are located at the rear of the truck. These cause the rear of the truck to swing out when a turn is made. With a little practice, this type steering is easily mastered.

B. FORWARD/REVERSE LEVER - POWER SHIFT

The power shift lever is located on the steering column and beneath the steering wheel. There are three positions - forward, neutral, and reverse (Fig 4-1). The lever actuates a hydraulic valve mounted on top of the transmission; this directs the flow of oil to actuate forward or reverse clutches.

> NOTE: On Power Shift models a safety switch incorporated in the shifting mechanism prevents engine startup with transmission in gear.

C. LIFT AND TILT CONTROLS

The lift, tilt, and accessory controls are located to the right of the operator (Fig 3-1).

D. PARKING BRAKE LEVER

The parking brake lever (Fig 3-1) is cam-action, over-center type, located on the instrument panel at the left side of the operator's compartment. It actuates an enclosed, dual-shoe mechanical unit attached to the brake drum flange. The hand grip on the handle permits adjustment to compensate for brake lining wear.

E. INCHING CONTROL - "POWER SHIFT"

The inching pedal is located at the lower left of the steering gear mounting support. A change in pedal stroke varies oil pressure in the clutch so truck can be "inched" along slowly while the engine is operated at high speed for fast lifts. The farther the pedal is depressed, the slower the truck travels. In fully depressed position, the clutch is completely disengaged and the service brakes are applied.

F. BRAKE PEDAL

The brake pedal, located to the right of the steering column, operates the brake master

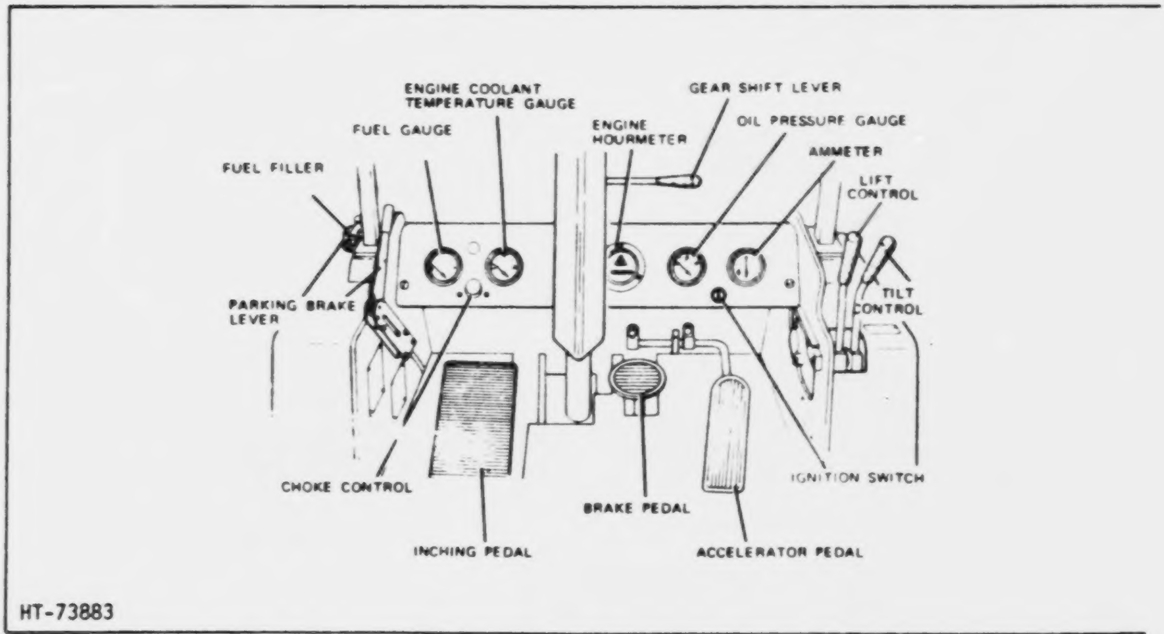

ENGINE COOLANT TEMPERATURE GAUGE
GEAR SHIFT LEVER
FUEL GAUGE
ENGINE HOURMETER
OIL PRESSURE GAUGE
FUEL FILLER
AMMETER
LIFT CONTROL
TILT CONTROL
PARKING BRAKE LEVER
CHOKE CONTROL
IGNITION SWITCH
BRAKE PEDAL
INCHING PEDAL
ACCELERATOR PEDAL
HT-73883

Figure 3-1. Controls and Instruments

cylinder which, in turn, actuates the wheel cylinder and brake shoes.

CAUTION: Always place the shift lever in neutral and set the parking brake before leaving the operator's seat.

G. ACCELERATOR PEDAL

The accelerator pedal, located to the right of the brake pedal, controls engine speed through linkage to the throttle lever on the carburetor.

H. INSTRUMENT PANEL

The instrument panel holds various gauges at a glareless, easy-to-read angle (Figure 3-1). The panel contains:

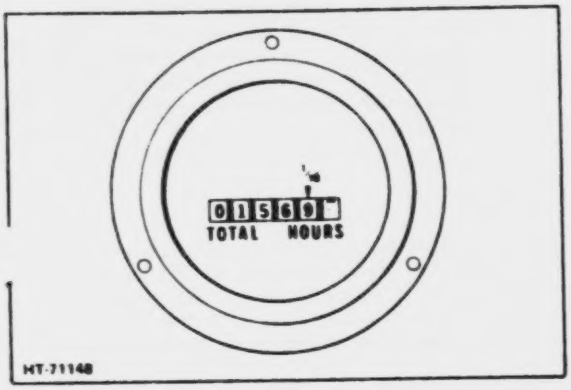


Figure 3-2. Hourmeter

1. Oil Pressure Gauge

The oil pressure gauge indicates the pressure of oil circulating through the engine. A cold engine will normally have a higher oil pressure than an engine that is warm.

CAUTION: Always check the oil pressure gauge immediately after the engine starts.

If the gauge does not register, or if it registers slightly (less than 5 psi at idle speed), stop the engine immediately and check the lubrication system to determine cause of lack of pressure.

2. Ammeter

The ammeter is connected into the main battery circuit and indicates whether current is flowing into or out of the battery. A needle deflection to the CHARGE side indicates that the battery is being charged by the alternator, and a deflection to the DISCHARGE side indicates that the battery is discharging. Normally, the rate will be high for a short time after starting the engine, then the indicator will return to a point slightly above zero after a few minutes operation. However, if battery is in a rundown condition, charge rate may be high for some time. If ammeter indicates DISCHARGE when engine is operated above idle speed, alternator is not producing current, or there may be a short in the wiring system. Investigate and repair at once.

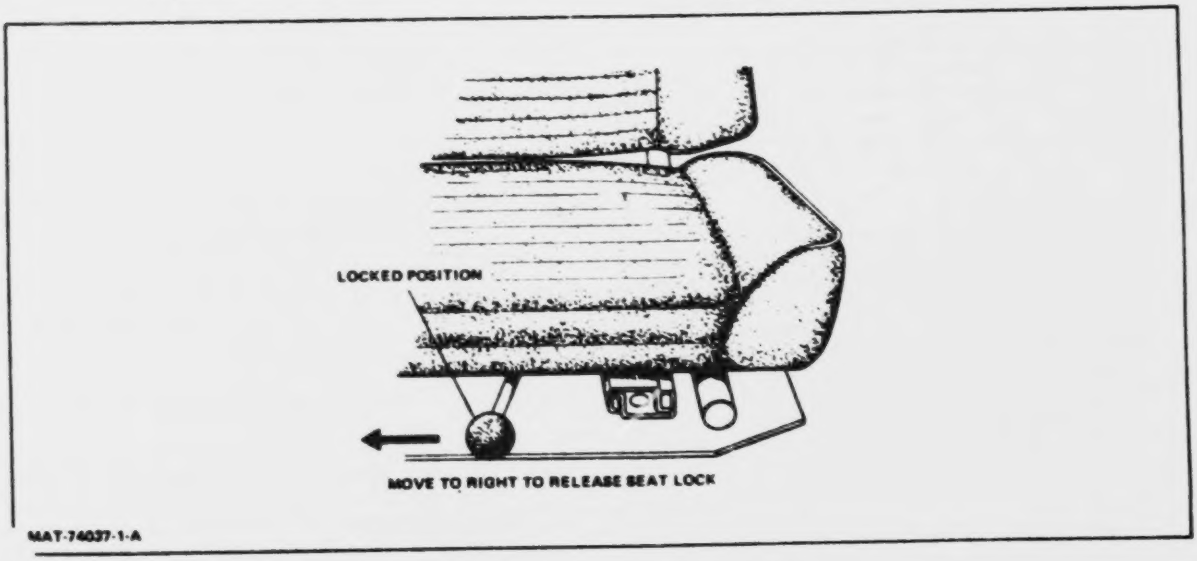

LOCKED POSITION
MOVE TO RIGHT TO RELEASE SEAT LOCK
MAT-74037-1-A

Figure 3-3. Operator's Seat Adjustment

3. Engine Coolant Temperature Gauge

Depending upon engine coolant temperature, the pointer of the gauge indicates one of three colored areas on the dial: a white, or engine warm-up area; a green, or safe operating area; or a red danger area. Optimum operating temperature is indicated when the pointer is over a mark in the center of the green area.

The engine is not designed for continous operation at high temperatures. If normal work loads on a level surface tend to produce near-boiling temperatures, check the cooling system - thermostat, radiator pressure cap, temperature sender, coolant, radiator air passages, core, etc. - to determine the cause and correct as necessary.

4. Fuel Gauge

The panel mounted electric fuel gauge indicates the level of fuel in the fuel tank.

5. Hourmeter

The hourmeter (Fig 3-2) registers accumulated engine running time to 9,999.9 hours and then repeats itself. The figure on the right registers tenths of an hour.

6. Ignition Switch

The standard ignition switch, located on the left side of the instrument panel, is a three-position switch. It is used to turn current on or off, control flow of current to instrument panel gauges, and allow current to flow to the starter motor solenoid. Turn the key all the way to the right to crank the engine and release it as soon as the engine starts.

7. Choke Control

The choke control, located on the left side of the instrument panel, controls the gasoline carburetor choke plate. Pull choke knob all the way out when starting a cold engine. Gradually push choke knob in as engine warms.

8. Transmission Temperature Gauge

The transmission temperature gauge, located on right side of instrument panel, indicates temperature of transmission oil. The dial indicates from 100° to 250°F. If gauge reaches 210°F, stop truck and correct overheating condition.

I. OPERATOR'S SEAT ADJUSTMENT

The operator's seat is adjustable forward and backward for maximum comfort. The adjusting lever is located below the front edge of the seat (Fig 3-3). Move lever to the right to release seat lock, then move seat forward or backward to desired position by shifting weight. Release the lever to lock the seat in position.

TOPIC 4. OPERATION OF LIFT TRUCK

The following instructions are based on past experience and should be helpful in becoming fully acquainted with your "Allis Chalmers" lift truck. See Figure 3-1 for location of instruments and controls.

A. STARTING THE ENGINE

1. Put shifting lever in neutral position. On power-shift models, the forward-reverse lever must be in neutral position.
2. Insert ignition switch key and turn clockwise to ON position.
3. Do not depress accelerator pedal until engine starts.
4. Pull the choke knob all the way out when starting a cold engine.
5. Turn the ignition key all the way clockwise to the START position to actuate the starter motor. Release key as soon as engine starts. Key will automatically return to ON position.

CAUTION: Do not operate starter motor for more than 30-seconds at a time. If engine does not start, allow starter motor to cool for approximately two minutes before again attempting to start engine.

6. After starting, gradually push in choke control knob as engine warms up. It is not necessary to use choke during normal operation or when starting a warm engine.

NOTE: Excessive use of the choke dilutes crankcase oil causing wear of piston rings and cylinder walls. It is recommended that engine oil be changed more frequently in cold weather because of this condition.

B. SHIFTING OPERATION "POWER SHIFT"

With engine idling, release parking brake. Place directional lever in either Forward or Reverse position (see Figure 4-1) and accelerate truck as required. To change direction, always come to a complete stop and simply move the directional control lever to either Forward or Reverse.

NOTE: Trucks equipped with power shift transmission have a return to neutral feature that will automatically shift the truck into neutral when the operator leaves the seat. To re-engage the transmission, the operator must return to operator's seat and manually return the shift lever to the desired position.

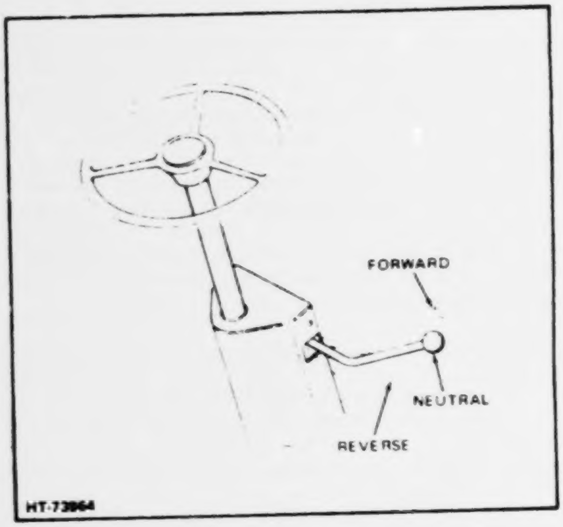


Figure 4-1. Power Shift Positions

C. LIFTING AND LOWERING OPERATIONS

Lifting and lowering action is controlled by the lever closest to the operator. (See Figure 3-1). Pull the lever back to lift and push it forward to lower. When the lever is released it will automatically return to the intermediate (NEUTRAL) position.

Rate of lift is controlled by speed of the engine and position of the lever. Slight acceleration of the engine and gradual movement of the lift lever from neutral to lift position will produce a slow lifting action. Accelerating the engine and pulling the lever back as far as possible increases the speed of lift. When the forks are raised to desired height, release lever smoothly to neutral position - forks and/or load will hold at this point.

Lowering speed is controlled by weight of the load and position of the control lever. Push lever forward slowly for smooth operation. To increase speed of lowering, push the lever forward as far as possible. Release lever slowly to neutral position as load reaches desired level. Maximum lowering speed is held within safe limits by a flow regulator in the oil port at the base of the lift cylinder.

CAUTION: Do not release lift control lever suddenly when lowering load because this causes severe mechanical shock.

D. TILTING OPERATIONS

The tilt control lever is mounted to the right of the lift lever (Fig 3-1). Rate of tilt is controlled by speed of the engine and position of the lever. Slight acceleration of the engine and gradual movement of the tilt lever from neutral to tilt position will produce a slow tilting action. Accelerating the engine and pulling the lever back or pushing it forward as far as possible increases the speed of tilt. When the mast is tilted to desired position, release lever smoothly to neutral position and mast will hold at this point.

CAUTION: Use care when tilting mast forward to prevent the load from toppling.

E. SIDE SHIFTER OPERATION (Not Applicable)

The side shifter control lever is mounted to the right of the tilt lever (Fig 4-2). Push the lever forward to move the carriage to the left. Pull lever back to shift carriage to the right.

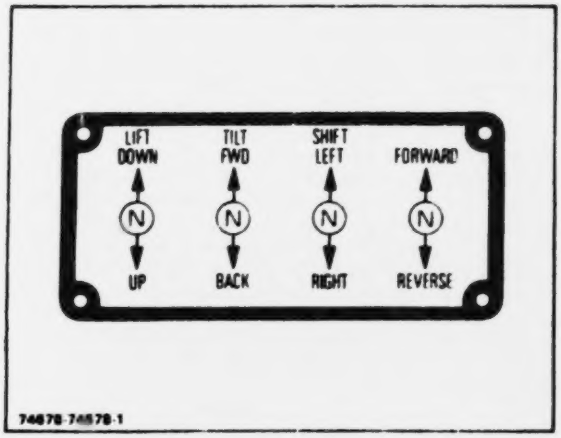


Figure 4-2. Raise, Lower, Tilt and Side Shift Positions

F. FORK ADJUSTMENT

For maximum balance, always position the forks in proportion to the width of the load. A fork lock in the top of each fork holds it in position in notches along the top bar of the carriage. To change fork location, pull up on lock and move fork right or left; allow lock to seat in notch nearest the location chosen (Fig 4-3).

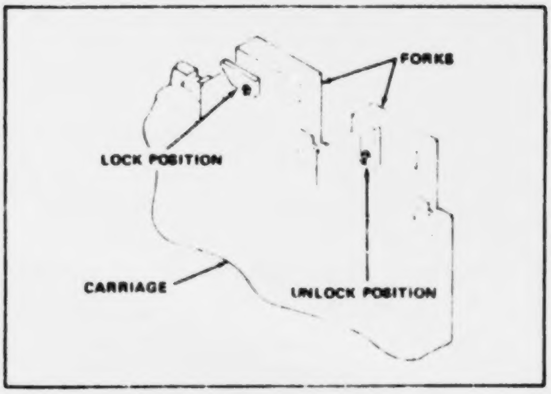


Figure 4-3. Fork Adjustment

Forks can be easily removed from the carriage by releasing the locks and aligning each fork (one at a time) with the wide slot on the bottom of the carriage. Remove fork by lifting it up and off the carriage.

G. LOAD HANDLING PROCEDURES

Lift truck stability is based on principles of the counter-balance and fulcrum (Fig 4-4). The drive axle of the lift truck is the balancing point (fulcrum). The load is carried at the front of the lift truck and is counterbalanced by the counterweight on the rear of the truck.

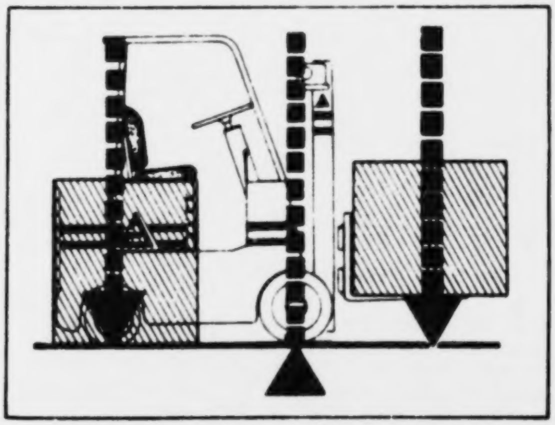


Figure 4-4. Counterbalance Principle

Stability of the truck is achieved by placing the load close to the fulcrum (near the face of the forks). Each lift truck is rated for specific load capacity at a given load center, usually at 24-inches. When various attachments or special masts are added, the load capacity and load center either increases or decreases, depending on the size and weight of the special mast or attachment. The load capacity of the lift truck should never be exceeded. Overloading the lift truck will: (1) be a hazard to the safety of others; (2) endanger other material; (3) damage the truck.

The following procedures are suggested to aid in operating your Allis-Chalmers lift truck. These are basic procedures that can be adapted to most load handling operations.

1. Lifting a Palletized Load

   a. Position the lift truck squarely in front of the load (Fig 4-5).

   b. Raise forks to the proper level, half way between the upper and lower members of the pallet. Watch for low-hanging pipes or electrical lines.

   c. With the mast in a vertical position and the forks parallel to the floor, slowly insert the forks into the pallet until the load rests against the fork faces. Unless the mast is vertical, the forks may hang up when they are inserted.

   d. Lift the load just enough to clear the stack (or floor) beneath the load being removed. Then tilt the mast back enough to safely travel with the load.

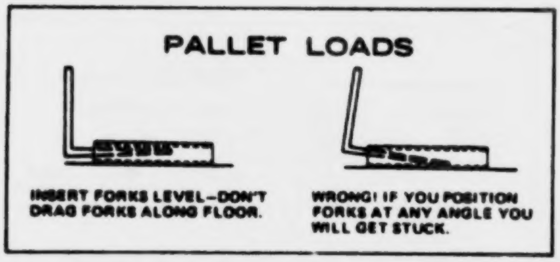

PALLET LOADS
INSERT FORKS LEVEL—DON'T DRAG FORKS ALONG FLOOR.
WRONG! IF YOU POSITION FORKS AT ANY ANGLE YOU WILL GET STUCK.

Figure 4-5. Palletized Load Handling

   e. Back the truck slowly away from the stock pile and when clear of all obstacles, lower the load. The load should always be carried as low as possible for maximum stability and vision. Maximum back tilt tends to cradle the load and prevent it from sliding off the forks when stopping.

CAUTION: If the load is so bulky that vision is obstructed, drive in reverse. Extra care must be taken when driving in reverse because the operator does not have a constant view of the load.

2. Traveling

   a. With heavy loads on the forks, steering is easier because the weight on the steer wheels is shifted forward.

   b. Obey all speed limit signs. If no speed limits are posted, travel at the safest speed that conditions allow.

   c. Always watch in the direction of intended travel.

   d. When ascending an incline, travel with load leading (Fig 4-6).

   e. Travel with the load trailing when descending an incline (Fig 4-7).

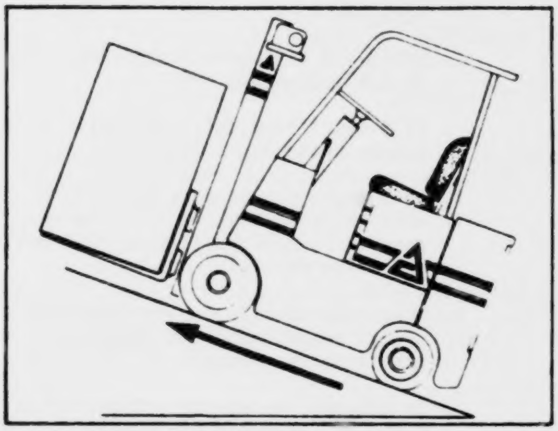


Figure 4-6. Ascending an Incline

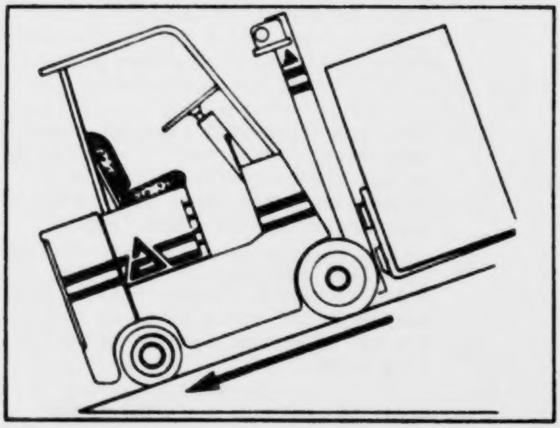


Figure 4-7. Descending an Incline

f. With an unloaded lift truck, ascend ramps with the counterweight leading. Descend the ramp with the counterweight trailing (Fig 4-8).

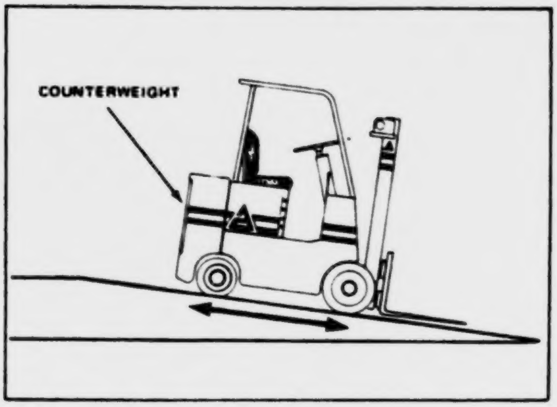

COUNTERWEIGHT

Figure 4-8. Unloaded Traveling Procedure

g. When ascending or descending a grade raise forks high enough to avoid hitting the ramp.

h. Cross all railroad tracks slowly and at a slight angle.

i. To prevent load spillage, apply brakes gradually and firmly.

j. When turning a corner, begin turn when front wheels are at a right-angle to the intended path of travel and allow for rear end swing.

k. Check the condition and capacities of all floors, dockboards, semi-trailer beds, etc.

l. To maneuver in narrow aisles, raise forks to clear the stock pile and gain additional maneuvering area. Extra care must be taken with the forks raised. Watch for low-hanging object such as water pipes, electrical lines, etc. (Fig 4-9).

m. When operating with elevated loads, keep mast in full back tilt position except when actually lifting or depositing loads. Back tilt also shortens effective truck length.

n. Take full advantage of operating space in narrow aisles. Stay as far away from the stock piles as possible but allow for rearend swing (Fig 4-10).

o. Enter box cars at a slight angle and begin turning as soon as possible (Fig 4-11).

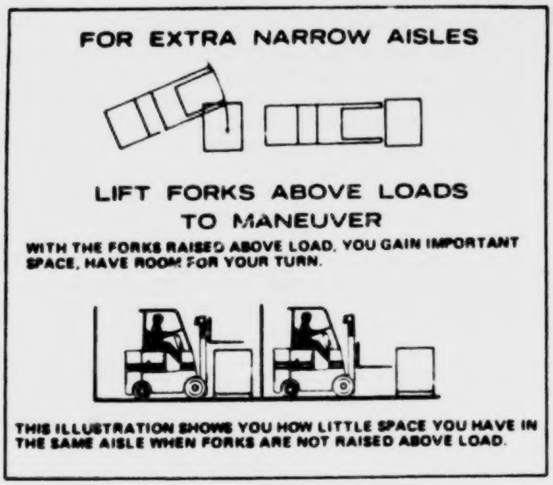

FOR EXTRA NARROW AISLES
LIFT FORKS ABOVE LOADS TO MANEUVER
WITH THE FORKS RAISED ABOVE LOAD, YOU GAIN IMPORTANT SPACE, HAVE ROOM FOR YOUR TURN.
THIS ILLUSTRATION SHOWS YOU HOW LITTLE SPACE YOU HAVE IN THE SAME AISLE WHEN FORKS ARE NOT RAISED ABOVE LOAD.

Figure 4-9. Narrow Aisle Maneuver

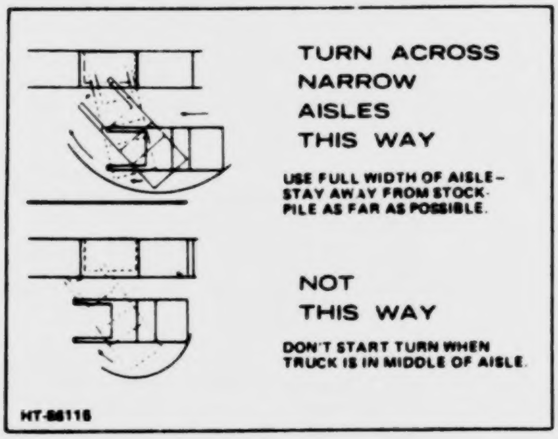

TURN ACROSS NARROW AISLES THIS WAY
USE FULL WIDTH OF AISLE—STAY AWAY FROM STOCK-PILE AS FAR AS POSSIBLE.
NOT THIS WAY
DON'T START TURN WHEN TRUCK IS IN MIDDLE OF AISLE.
HT-66116

Figure 4-10. Aisle Turning Procedure

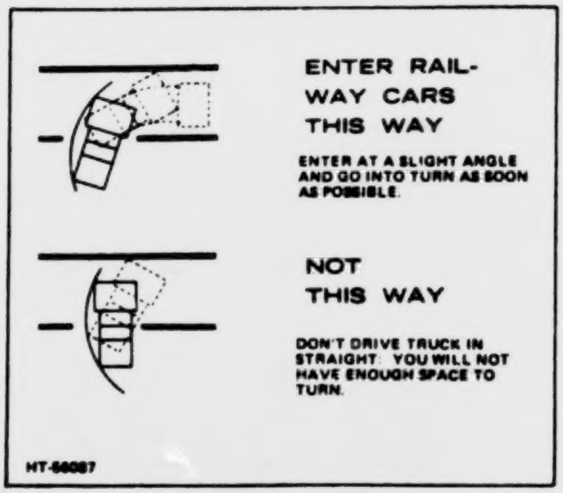

ENTER RAIL-WAY CARS THIS WAY
ENTER AT A SLIGHT ANGLE AND GO INTO TURN AS SOON AS POSSIBLE.
NOT THIS WAY
DON'T DRIVE TRUCK IN STRAIGHT: YOU WILL NOT HAVE ENOUGH SPACE TO TURN.
HT-60087

Figure 4-11. Entering Railway Cars

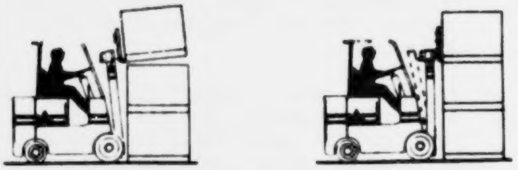
3. Positioning, Stacking, and Unloading

a. Drive the loaded lift truck to the stacking area.

b. If possible, position the truck squarely in front of the stock pile.

c. Check all low-hanging obstructions. Raise the load with the mast tilted slightly back (Fig 4-12).

STACKING



RAISE LOAD WITH MAST TILTED BACK. DRIVE TRUCK AS CLOSELY AS POSSIBLE TO STACKING AREA.

SET DOWN LOAD BY TILTING MAST FORWARD INTO VERTICAL POSITION. BE CAREFUL THAT FORKS WILL NOT HANG UP

Figure 4-12. Stacking and Positioning

d. With the load elevated, move the truck slowly forward and position the load squarely over the stock pile.

e. Stack loads squarely and evenly to make use of all available space. Stock piles should always be stable to avoid injury to personnel and damage to equipment or stock.

f. Tilt the mast forward to vertical position and lower the load slowly into position.

g. Back lift truck slowly away from load to withdraw the forks.

h. With the forks clear of the stock pile, lower them to within 2-inches of ground level before proceeding.

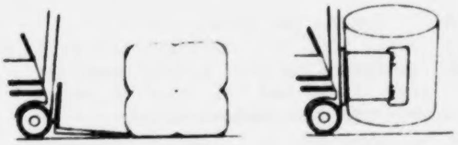
4. Unpalletized Loads

Special attachments are often used to handle unpalletized loads. If these attachments are not available and the load must be stacked or moved, proceed as follows:

a. Tilt the forks forward so their tips contact the floor (Fig 4-13).

b. As carefully as possible, insert forks under the load until the load is contacted by the vertical fork faces.

UNPALLETIZED LOADS



TO PICK UP LOADS THAT ARE NOT ON PALLETS, ON SKIDS, OR ON DUNNAGE, A CAREFUL APPROACH SHOULD BE MADE TO THE LOAD WITH A SLIGHT DOWNWARD OR FORWARD TILT OF FORKS AT THE GROUND LEVEL. NORMALLY LOADS OF THIS MATERIAL ARE HANDLED USING VARIOUS ATTACHMENTS.

Figure 4-13. Unpalletized Load Handling

c. Tilt the load slightly back.

d. To stack unpalletized loads, position the truck squarely in front of the stock pile. Raise forks to proper level with the mast tilted back.

e. Position load squarely over the stock pile, then lower the forks slowly until they rest on the stock.

f. Tilt the load slightly forward and begin to back the truck. Proceed carefully to prevent damage to the load.

g. Withdraw the forks from the stack and lower them to within 2-inches of the floor.

H. STOPPING THE TRUCK

To bring the truck to a safe, smooth stop, apply gradual pressure on foot brake pedal. When parking, pull back hand brake lever, place shift lever in neutral, and lower forks to floor.

Allow the engine to idle for a few minutes before turning off ignition switch; this allows it to cool gradually. Too rapid cooling of an extremely hot engine may warp valves or even crack the manifold. After idling for a short while, turn ignition key to OFF position. Key should always be removed from the ignition switch to prevent unauthorized use of the truck.

I. DAILY CHECK LIST

Refer to the following Paragraph J for detailed explanation of each inspection.

NO.	INSPECTIONS	DAILY
1.	Steer Axle Stops	X
2.	Overhead Guard	X

NO.	INSPECTIONS	DAILY
3.	Battery	X
4.	Engine Oil Level	X
5.	Fuel Tank	X
6.	Radiator Coolant Level	X
7.	Tires	X
8.	Hourmeter	X
9.	Accelerator Pedal (Operational Check)	X
10.	Brakes (Operational Check)	X
11.	Steering (Operational Check)	X
12.	Lifting and Lowering Speed (Operational Check)	X
13.	Forward and Backward Tilt (Operational Check)	X
14.	Unusual Noise (Operational Check)	X
15.	Fire Extinguisher	X

J. DAILY CHECK LIST EXPLANATION

The following explanations correspond to the inspections in the Daily Check List. It is necessary to perform these inspections daily. Should any discrepancy be found, it should be reported to the supervisor or the responsible maintenance personnel.

1. Steer Axle Stops - Check the steer axle stops at the beginning of each work shift. These stops are welded to the truck frame in such position that one is directly above each of the steer axle yokes (Fig 4-14). Turn the steer wheels to full right and to full left positions. Visually check positions of both axle stops; make certain they are not missing, bent, or otherwise damaged.

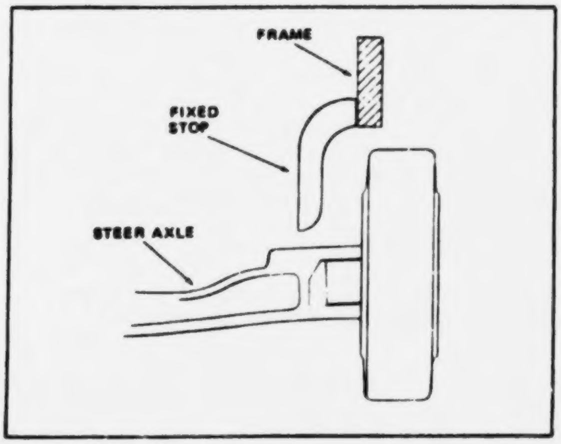


Figure 4-14. Steer Axle Stop

2. Overhead Guard - Inspect welds and hardware attaching overhead guard to the truck proper. Make sure all attaching hardware is in place and all welds and structural members are secure.

3. Battery - Check condition of battery as described in Topic 5 - BATTERY. Also, make sure that the battery cables are not damaged or loose and that the connector lugs are clean and securely attached.

4. Engine Oil Level - Check level with dipstick. If necessary, add oil to raise level to FULL mark. Refer to Topic 6 in this manual titled LUBRICANT SPECIFICATIONS for proper oil recommendation.

5. Fuel Tank - Fill fuel tank at end of each workday; this practice will prevent the condensation of moisture.

6. Radiator Coolant Level - Maintain coolant level approximately 1-inch below bottom of radiator filler tube. Add clean fresh water or antifreeze as required.

7. Tires - Check pressure of pneumatic tires. If necessary, fill to pressure recommended in the Maintenance Manual. Check tires for excessive wear and damage. Unevenly worn or badly damaged tires will vibrate excessively and cause hard steering. Remove steel chips and other foreign materials from tire treads to prevent further damage.

8. Hourmeter - Turn key switch ON and make sure hourmeter is energized.

9. Accelerator Pedal - The truck should accelerate smoothly from slow to fast speed.

10. Brakes - The brake pedal should have 1/2-inch free play when it is depressed. The truck should stop with normal brake pressure. When pedal is fully depressed, some reserve distance should remain. Check during operation.

11. Steering - The truck should steer smoothly and freely. Check during operation.

12. Lifting and Lowering - The mast and forks, or attachment combination, should raise and lower, accelerate and decelerate smoothly. Check during operation.

13. Forward and Backward Tilt - Operation of forward and backward tilt should be immediate and smooth. Check during operation.

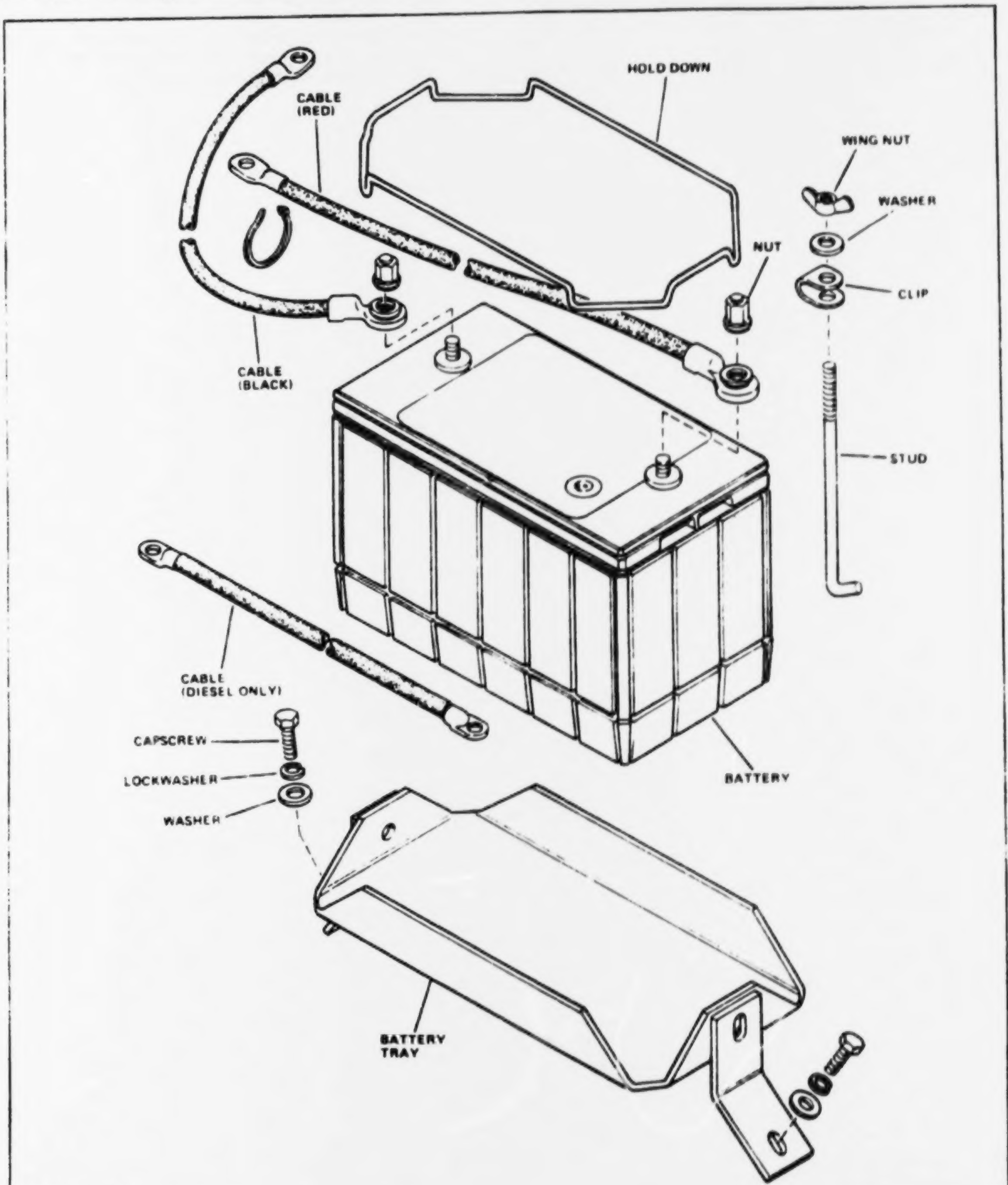
14. Unusual Noise - During operation, note unusual mechanical noise and report it to the supervisor or to another responsible person.

15. Fire Extinguisher - If lift truck is equipped with a fire extinguisher, examine cylinder for bad dents. Make sure it has not been used and left empty by checking gauge, if so equipped, or seal wire to determine whether or not it has been broken during usage.

TOPIC 2. BATTERY

A. DESCRIPTION

A 12-volt battery, mounted in a steel tray under the rear deck plate, is held securely in place by a hold-down clamp. Electrical energy drained from the battery, through operation of


HOLD DOWN
CABLE (RED)
WING NUT
WASHER
NUT
CLIP
CABLE (BLACK)
STUD
CABLE (DIESEL ONLY)
CAPSCREW
LOCKWASHER
WASHER
BATTERY
BATTERY TRAY

770518 770288 1

Figure 2-1. Battery and Components

various units in the system, is restored by the regulated alternator.

B. SERVICE

1. The battery is a sealed unit, requiring no electrolyte testing or addition of water. A charge state indicator is provided as part of the battery. It is located near the positive (+) terminal.

   Battery mounting is as shown in Figure 2-1, with the battery positive post connected to the cable leading to the starter solenoid, while the negative post is connected to ground on the engine block.

2. Check external condition of battery terminals and battery cables. Top of battery should be kept clean and the battery hold-down clamp should be properly secured. If the top of the battery is dirty and/or corroded, it should be cleaned with a strong soda solution and a soft bristled brush. After foaming stops (corrosive acid dissolved) flush top of battery with clean water.

⚠ WARNING

To prevent possibility of bodily injury, always disconnect battery-to-ground cable before cleaning, repairing, or performing maintenance on the lift truck.

   Battery cable terminals should always be tight on the battery posts to maintain good electrical contact. Cables should be in good condition, without broken strands or defective insulation. If battery posts and cable terminals are corroded, the cables should be removed, and the posts and terminals cleaned separately, using a strong soda solution and wire brush. Install cables and securely tighten terminals to 10-15 lb-ft of torque.

C. REMOVAL

1. Remove the rear deck plate to gain access to the battery.
2. Disconnect the positive and negative cables from their respective posts.
3. Remove the wing nuts from the hold-down studs and remove hold-down clamp.
4. Remove battery.

D. INSTALLATION

1. Maintain replacement battery in an upright position, tilting only as required for fit, during installation.
2. Be certain battery is replaced with the negative (-) post closest to the engine.
3. Make certain battery posts and cable terminals are clean. Securely connect the positive cable to the positive post and the negative cable to the negative post.
4. Do not hammer cable terminals on posts as this practice will ruin battery.
5. Tighten the cable connectors on their proper terminal posts to a torque of 10-15 lb-ft.

MEMO

TOPIC 6. LUBRICANT SPECIFICATIONS

A. ENGINE LUBRICATING OIL

Lubricating oils used in Allis-Chalmers engines must:

1. Maintain pistons, rings, and other moving parts in a carbon-free, varnish-free, clean condition.
2. Maintain enough body to satisfactorily lubricate the moving parts at maximum oil temperatures.
3. Prevent bearing corrosion. Counteract corrosive products of combustion or contaminants in the fuel.
4. Promote general cleanliness within the engine.

The American Petroleum Institute has several service classifications for oils used in gasoline and LP gas engines; they are SA, SB, SD, and SE.

SERVICE SA: Service typical of engine used under light and favorable operating conditions, the engines having no special lubrication requirements and having no design characteristics sensitive to deposit formation.

SERVICE SB: Service typical of engines used under moderate to severe operating conditions, but presenting problems of deposit corrosion control when lubricating oil temperatures are high.

SERVICE SD: Service typical of engines used under unfavorable or severe types of operating conditions and where there are special lubrication requirements for deposit, wear, or bearing corrosion control, due to operating conditions, or engine design, or fuel characteristics.

SERVICE SE: Oils designed for this service provide more protection against oil oxidation, high temperature engine deposits, rust, and corrosion in gasoline engines than oils which are satisfactory for classification SD.

Generally, SERVICE SB will apply to the gasoline engine.

Use oils of the following viscosities:

Ambient Temperature	Viscosity
Below 32°F	SAE 20 W
32°F to 90°F	SAE 30
Above 90°F	SAE 40

Our recommendation of 100 hours for filter and oil change periods is based on the use of high quality oils and 85% average engine loads with the engine in good adjustment and operating with the coolant and lubricating oil at normal operating temperature. Variations from the considered normal operating conditions must be compensated for by more frequent oil change and filter change periods.

Our recommended oil change periods are based on what experience has shown to be conservative and safe hours of operation between oil changes. Actual testing of the lubricating oil in a particular engine application at each 5 to 10 hours operation after 100 hours operation to determine the condition of the oil may allow extending the oil change periods. This testing service is provided by most major oil companies. It is recommended to take advantage of this service.

B. HYDRAULIC SYSTEM OIL

Use a hydraulic oil that conforms to Allis-Chalmers specification MA 170.103 or SAE 10 SE engine oil (or MIL-L-2104B) in the hydraulic system.

The hydraulic oil must be fortified with special rust and oxidation inhibitors, plus anti-wear ingredients, and treated to minimize foaming. The hydraulic oil must conform to the following in Allis-Chalmers specification MA 170.103:

Viscosity at 100 F SUS.	150 - 170 secs
Viscosity Index	90 min
Flash Point	370°F min
Neutralization No. (mgs KOH/g oil)	0.60
Aniline Point	180°-220°F
Oxidation Stability (hrs. to neut. No. 1.0 max)	1500
Rust Test	Pass
Copper Strip Corrosion (3 Hours at 212°F)	Pass 2B
Pour Point	-20°F max

The SAE grade 10 SE engine oil is available at all major oil companies and most local service stations. The oil meets the requirements of the American Petroleum Institute and contains rust and oxidation inhibitors, anti-wear ingredients, and an anti-foaming agent.

Hydraulic system oil storage containers must be kept free of contaminants, such as dirt, water, and metal chips. Contaminated hydraulic oil is the major cause of hydraulic system failures. It is therefore advised that any oil that is added or replaced be final filtered through a ten micron filter (or finer) before entering the hydraulic system. It is recommended that each storage container be clearly marked - FOR USE IN HYDRAULIC SYSTEM ONLY.

C. POWER SHIFT TRANSMISSION OIL

Use ATF (Automatic Transmission Fluid) Type "A", Suffix "A", which can be obtained from major oil companies.

D. DIFFERENTIAL LUBRICANT

Lubricate with SAE 90 EP (extreme pressure gear oil which is non-corrosive and resists oxidation and foaming. It should have a low pour point to ensure quick lubrication at either high or low temperatures.

E. BULL GEAR AND JACKSHAFT PINION

Lubricate with high quality. Grade 2 lithium base grease (characterized by the word "Moly") that contains a maximum of 5% micronized molybdenum disulfide. Lubricant should be waterproof and heat resistant.

F. WHEEL BEARINGS AND JACKSHAFT BEARINGS

Use grease of the type specified in preceding paragraph E. Apply grease with an applicator that is designed to force it into the bearing rollers. Do not paint, dip, or swab it on by hand.

G. PRESSURE GUN FITTINGS

Lubricate with a high quality chassis lubricant. N. L. G. I. Grade 2 heavy duty sodium base grease available from any reputable oil company.

H. OIL CAN POINTS

Lubricate all points with SAE #10 or #20 engine oil.

I. BRAKE MASTER CYLINDER

Use only premium quality, heavy duty brake fluid with an extreme heat-cold range that conforms to SAE specification J1703d.

J. MASTS

Lubricate all sliding and roller contact surfaces of mast uprights with a high quality grease specified in prededing Paragraph E or G.

TOPIC 7. LUBRICATION AND SERVICE

The following paragraphs provide the operator/maintenance man with a comprehensive list of service operations that should be performed periodically. Close adherence to the list by qualified personnel will go far toward preventing major trouble and subsequent downtime of equipment. The operator is normally responsible for performing the 8-hour Daily Checks only; it is the responsibility of the maintenance man to perform the 50- to 1000-hour Service Checks. For detailed service information on these checks, the maintenance man may refer to applicable topics in the maintenance manual.

> NOTE: The time intervals given in this guide are based on normal operating conditions. When operating under abnormal or severe conditions, these services should be performed as often as required to maintain the vehicle in good operating condition.

A. 8-HOUR SERVICE

Refer to Daily Check List and Explanations in Topic 4.

B. 50-HOUR SERVICE

Perform 8 hour service in addition to the following:

Pressure Gun Fittings - Lubricate.
Mast and Carriage - Lubricate sliding and roller contact surfaces.
Oil Can Points - Lubricate.
Lift and Tilt Cylinders - Inspect for leaks.
Air Cleaner - Check and service element.
Battery - Check electrolyte level and charge condition.
Wiring and Connections - Check insulation and make certain connections are tight.
Clean Truck - Use industrial type vacuum cleaner or light air pressure (40 psi max.).
Adjust valve clearance after first 50 hours of operation.

C. 100-HOUR SERVICE

Perform 8 and 50 hour service in addition to the following:

Lift Chains - Clean and inspect for bent or cracked links. Inspect for adjustment and lubricate.
Differential level - Check Oil.
Drive Axle Housing Breather - Check and clean.
Hydraulic Oil Reservoir - Check hydraulic oil level.
Engine Breather Cap - Remove and clean.
Engine Oil Filter - Replace.
Engine Oil - Drain and refill.
Fan Belt - Check condition and tension.
Fuel Strainer - Clean.
Power Shift Transmission - Check fluid level.
Radiator - Make certain radiator air passages are free of obstructions.

D. 200-HOUR SERVICE

Perform 8, 50, and 100 hour service in addition to the following:

Hydraulic Oil Filter - Replace.
Transmission Oil Filter - Replace.
Hydraulic Oil Reservoir Breather - Replace.

E. 500-HOUR SERVICE

Perform 8, 50, 100, and 200 hour service in addition to the following:

Electrical System - Check tightness of terminals, wires, cables and electrical components.
Distributor - Replace points.
Spark Plugs - Replace.
Control Valve - Check linkage.
Fork Carriage - Check for side play and check chain adjustment if carriage is not level.
Lift Chains - Remove, clean and inspect for wear and broken or cracked links. Install, adjust, and lubricate.
Brake Master Cylinder - Check fluid level.
Wheel Cylinders and Brake Shoes - Inspect.
Hoses, Tubes, and Fittings - Inspect and replace if necessary. Correct any leaks that are evident.
Steer Wheel Bearings - Clean and lubricate.
Crankcase Vent Valve (if so equipped) - Remove and clean.
Universal Joint - Check and adjust if necessary.
Parking Brake - Check and adjust if necessary.

F. 1000-HOUR SERVICE

Perform 8, 50, 100, 200, and 500 hour service in addition to the following:

Cooling System - Drain, flush, and refill.
Differential - Drain oil and refill.
Power Shift Transmission - Drain fluid and refill.
Hydraulic Oil Reservoir - Drain hydraulic oil, flush, and refill.

MEMO

SECTION II

MAINTENANCE INSTRUCTIONS

MAINTENANCE INDEX

TOPIC TITLE PAGE

ENGINE

1 DESCRIPTION & SPECIFICATIONS 2-1
2 VALVES 2-4
3 OIL FILTER 2-5
4 OIL PRESSURE REG. VALVE 2-5
5 ENGINE TUNE-UP 2-6
6 TROUBLESHOOTING CHART 2-11

FUEL SYSTEM

1 FUEL SYSTEM 2-16
2 AIR CLEANER 2-18
3 FUEL TANK 2-19
4 FUEL PUMP & FILTER 2-19
5 CARBURETOR 2-20
6 ACCELERATOR & GOVERNOR 2-21

ELECTRIC SYSTEM

1 ELECTRIC SYSTEM 2-23
2 BATTERY 2-24
3 ALTERNATOR & REGULATOR 2-25
4 STARTER 2-27
5 ELECTRICAL WIRING 2-28
6 HORN & RELAY 2-29
7 IGNITION COIL 2-30
8 DISTRIBUTOR 2-32
9 INSTRUMENT PANEL 2-35

COOLING SYSTEM

1 COOLING SYSTEM 2-39
2 RADIATOR 2-41
3 WATER PUMP 2-43
4 THERMOSTAT 2-45
5 FAN & BELT 2-47

TRANSMISSION

1 TRANSMISSION 2-49
2 CHECK-OUT PROCEDURES 2-53
3 SHIFTING MECHANISM 2-56
4 OIL COOLER 2-58
5 OIL FILTER 2-59
6 UNIVERSAL JOINT 2-61

DRIVE AXLE

1 DRIVE AXLE 2-63
2 HYDRAULIC BRAKES 2-69
3 DIFFERENTIAL 2-69

BRAKE SYSTEM

1 BRAKES 2-75
2 MASTER CYLINDER 2-76
3 DRIVE WHEEL BRAKES 2-77
4 PARKING BRAKE 2-78

TOPIC TITLE PAGE

POWER STEERING

1 STEERING 2-79
2 STEER AXLE 2-80
3 STEERING WHEEL & COLUMN 2-82
4 DRAG LINK 2-83
5 TIE ROD 2-83
6 CYLINDER 2-83
7 WHEELS & TIRES 2-84

HYDRAULIC SYSTEM

1 HYDRAULIC SYSTEM 2-85
A. GENERAL 2-85
B. MAINTENANCE 2-85
C. DAILY INSPECTION 2-85
D. 50 HOUR INSPECTION 2-85
E. 200 HOUR INSPECTION 2-86
F. 500 HOUR INSPECTION 2-87
G. 1000 HOUR INSPECTION 2-87
H. HYDRAULIC PUMP 2-87
I. CONTROL VALVE 2-88
J. CHECKING CONTROL VALVE INLET PRESSURES 2-88
K. LIFT CYLINDER 2-89
L. TILT CYLINDER 2-89
M. STEERING 2-90

FRAME & COUNTER WEIGHT

1 FRAME 2-91
2 COUNTER WEIGHT 2-91
3 BODY COMPONENTS 2-94
4 OVERHEAD GUARD 2-96

HIGH FREE LIFT MAST

1 GENERAL 2-97
2 MAST ASSEMBLY 2-98
3 LIFT CYLINDER 2-99

CARRIAGES, SIDESHIFTER & FORKS

1 CARRIAGE 2-101
3 FORKS 2-104

TROUBLESHOOTING CHARTS

A. FUEL SYSTEM 2-105
B. COOLING SYSTEM 2-107
C. HYDRAULIC SYSTEM 2-108
D. DRIVE UNIT 2-109
E. HYDRAULIC BRAKE SYSTEM 2-110
F. POWER STEERING SYSTEM 2-111
G. MAST HYDRAULIC SYSTEM 2-112
H. TRANSMISSION 2-113
I. ELECTRICAL SYSTEM 2-114

LUBRICANT & FUEL SPECIFICATIONS

1 LUBRICANT SPECIFICATIONS 2-116
2 FUEL SPECIFICATIONS 2-117
3 LUBRICATION CHART 2-119

TOPIC 1. DESCRIPTION AND SPECIFICATIONS

A. DESCRIPTION

The engine (Figure 1-1) is a four-stroke-cycle and L-type head design, with the valves arranged in the engine block. The main body consists of a single unit cylinder block and crankcase with integrally cast cylinders.

The aluminum pistons have four rings: The top two for compression, the third for scraping and the three-piece bottom ring for oil control. The full floating piston pins are retained by snaprings.

The front drive gear is keyed and pressed in place, and is sealed to the crankcase by a die cast filler block. The rear shaft extension is sealed to the crankcase by a die cast oil guard and a filler block.

The camshaft rotates in bearings located in the three main crankcase bulkheads. Camshaft drive is provided by the crankshaft timing gear. A gear located on the camshaft drives the oil pump shaft and its coupled distributor drive shaft. The fuel pump is actuated by an eccentric cam located towards the rear of the shaft.

The main and connecting rod bearings are of precision construction.

The entire length of the heat treated, steel forged connecting rods is rifle drilled for pressure lubrication of the piston pins.

The cylinder head is constructed of special alloy iron with carefully engineered water passages to ensure optimum cooling.

The intake manifold has individual porting (Figure 1-2) whereby each cylinder is fed with the fuel-air mixture individually and not influenced by other cylinders of the engine.

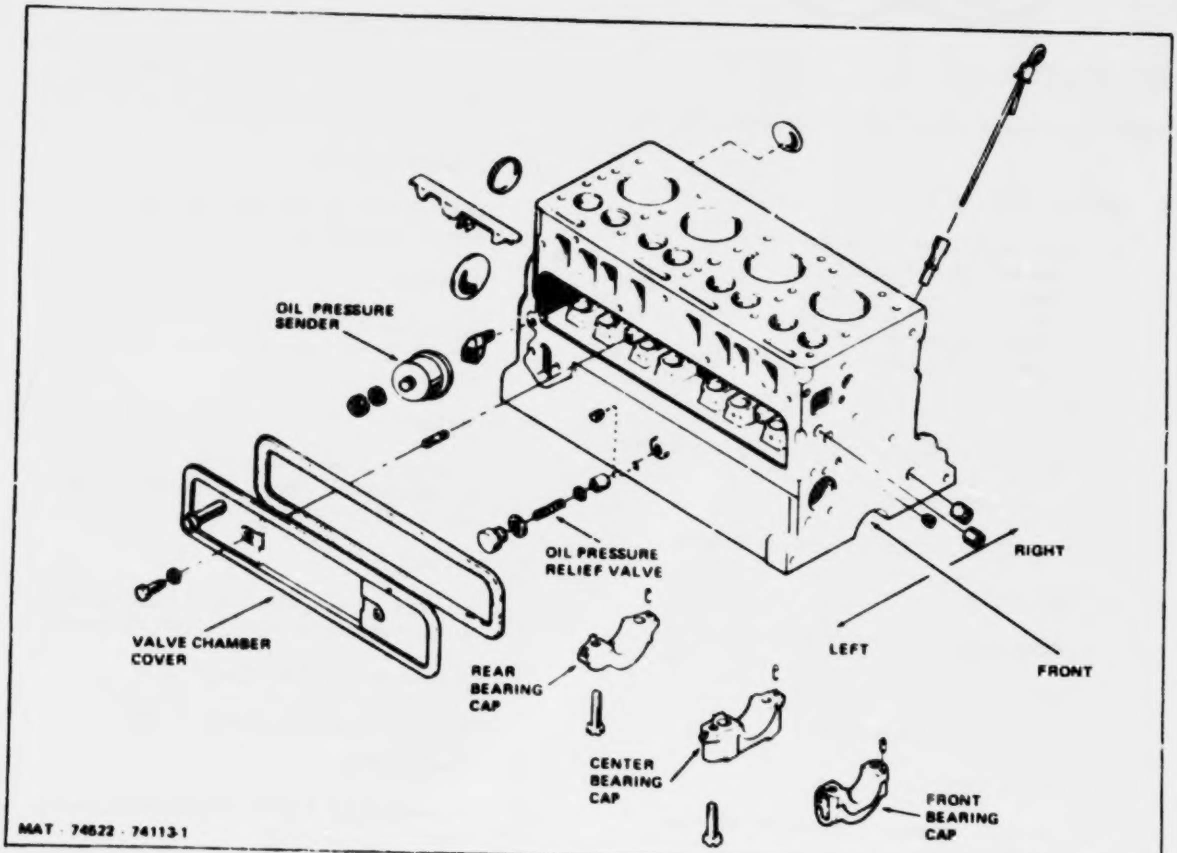


Figure 1-1. Cylinder Block Disassembled

This is accomplished by casting the cylinder block with individual intake valve passages for each cylinder and connecting these passages to an intake manifold which also has individualized passages for each cylinder.

This equal distribution results in maximum power, smooth operation, easy starting and longer engine life.

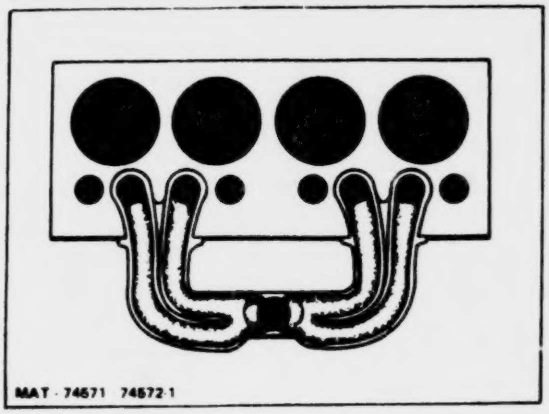


Figure 1-2. Intake Manifold Individual Porting

B. GENERAL SPECIFICATIONS

1. Size and Piston Displacement

	F163
Number of cylinders	4
Bore	3.4375
Stroke	4.375
Displacement (cu. in.)	162
Compression Ratio	7.4:1

2. Type

Four stroke cycle - naturally aspirated.

3. Crankshaft Rotation

Clockwise facing fan end of engine.

4. Suspension

Three point on rubber bushings.

5. Ignition

Battery and distributor.

6. Firing Order

1-3-4-2. Number 1 cylinder at fan end of engine.

7. Spark Plugs

Standard metric 18 MM thread.

8. Lubrication

Forced feed by oil pump driven directly off camshaft, to all main, connecting rod and camshaft bearings as well as tappets and timing gears.

9. Cooling

Coolant circulated by centrifugal pump driven by "V" belt from fan drive pulley.

Full pressure flow through engine at all times.

Engine capacity - 5 qts.

Engine and Radiator capacity - 9 qts.

10. Oil Pressure

Maximum - 30-40 p.s.i.

Minimum (Idling) - 7 p.s.i.

11. Oil Sump Capacity

Four quarts - add one-half quart extra when oil filter is replaced. Throw-away cartridge type filter.

12. Connecting Rods

Drilled for piston pin lubrication. Bronze bushing at piston pin end.

13. Camshaft

Supported by 3 replaceable bearings. Driven by helical gear from the crankshaft.

14. Pistons

Aluminum with four piston rings - 2 compression rings, 1 scraper ring and 1 oil control ring.

15. Valves

Located in cylinder block. Operated by valve tappets directly from camshaft.

Intake Valve Clearance - .012

Exhaust Valve Clearance - .020

16. Crankshaft

Supported by 3 main replaceable bearings.

17. Fan Drive

Belt and "V" pulley on fan drive adapter.

18. **Gear Train**

Helical gears (3) - crank gear, cam gear and fan drive gear.

19. **Governor (Type I)**

Centrifugal actuated, surge compensated, weight type driven by drive plate and pin from the gear train. The range of governor action is indicated by the differential between RPM under no load and RPM under-load.

20. **Governor (Type II)**

Cam gear type governor. Balls in driver assembly are forced outward by centrifugal force against race assembly. Tension of governor spring is counteracted by this force against race assembly bearing on governor lever. Governor is surge compensated.

C. ENGINE TUNE-UP SPECIFICATIONS

Timing 0-Deg. T.D.C. (STATIC)
or up to 500 RPM

Valve Lash
  Intake @ Operating Temperature... .012"
  Exhaust @ Operating Temperature.. .020"
  Distributor Settings F163
    Point Gap .... .020"
    Dwell 66-72
Firing Order..................... 1-3-4-2
Plug Gap .... .025"
Low Idle .... 400-600 RPM
High Idle .... 2400 ± 50 RPM
Compression .... 10 p.s.i. max. variance @ 150 RPM (Engine Cranking Speed)
Oil Pressure, 180° .... 7 p.s.i. @ 450-500 RPM - Min.
30-40 p.s.i. @ 2400 RPM - Max.
Oil Capacity..... Oil Change, w/o filter - 4 qts.
Oil Change, w/filter- 4 1/2 qts.

TOPIC 2. VALVE ADJUSTMENT

A. DESCRIPTION

The valve tappets (Figure 2-1) are removable. These large, barrel shaped, pressure lubricated tappets are so designed that by removing the adjusting screw, the main body can be lifted out and replaced from above through the valve chamber. This eliminates the costly service operation of dropping the oil pan and pulling the camshaft. Locking of the adjustment is both simple and effective.

Accurate valve tappet settings materially prolong engine life and aid performance. In addition to impairing performance, excessive clearances are detrimental to cams and tappets as well as to the rest of the valve mechanism. When clearances are too low, the possibility of burned valves increases.

B. ADJUSTMENT

Check and adjust intake and exhaust tappets to following clearances at running temperature:

Intake - .012"
Exhaust - .020"

To adjust valve tappets proceed as follows:

1. Disconnect and ground the high tension coil wire to prevent accidentally starting the engine.
2. Remove the valve tappet cover from the left side of the crankcase.
3. Remove the spark plug from number one cylinder.
4. Place thumb over the spark plug opening and slowly crank the engine until an outward pressure can be felt. Pressure indicates number one piston is moving toward Top Dead Center of the compression stroke. Continue cranking until the timing mark on the flywheel is in center of the flywheel housing timing hole. Both valves are then closed on the compression stroke of number one cylinder.
5. Use two thin wrenches when adjusting valve clearance. Use the lower wrench to hold the tappet and the upper wrench to raise or lower the tappet adjusting screw. When the valve lash is properly adjusted, the appropriate feeler gauge should pass between the tappet and its corresponding valve stem with a slight drag (Figures 2-2 and 2-3).
6. Crank the engine one-half revolution at a time and check the clearance of each valve; adjust if necessary. Do this on each set of cylinder valves in succession according to the firing order of the engine, which is 1-3-4-2.
7. Install new gasket and install valve tappet cover. Check to see that the valve cover makes an oil-tight seal with the crankcase.
8. Replace the spark plug, spark plug wire and coil wire.

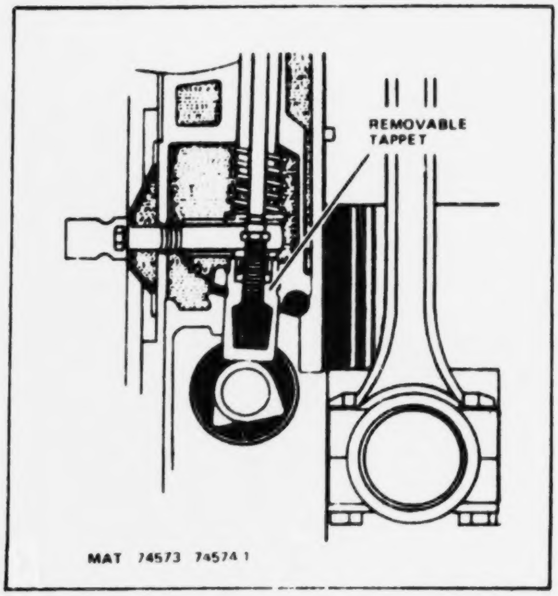


Figure 2-1. Removable Valve Tappet

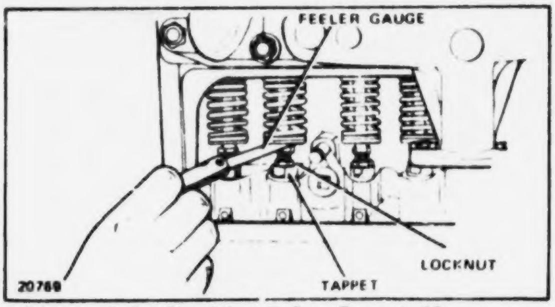


Figure 2-2. Checking Valve Tappet Clearance

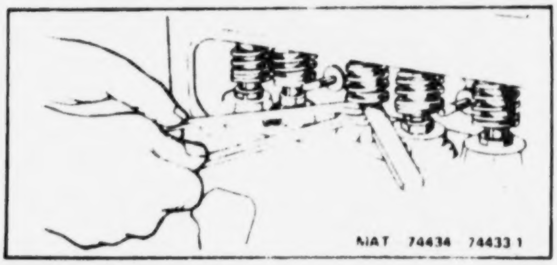


Figure 2-3. Adjusting Valve Tappet Clearance

TOPIC 3. OIL FILTER

A. DESCRIPTION

The engine oil is filtered through a "Spin On" by-pass type, throw-away, oil filter cartridge. This filtering is necessary to minimize the possibility of oil contamination, such as metal chips, carbon, dirt, etc., that may have inadvertently entered the oil supply, causing excessive wear to the engine parts.

The oil filter cartridge should be replaced at every oil change.

B. REMOVAL

1. Remove and discard filter cartridge and clean out all oil residue in filter base mount (Figure 3-1).

C. INSTALLATION

1. Install replacement filter cartridge. Spread light coat of oil between the cartridge and the mounting, and hand tighten ONLY.
2. Start engine and check for leaks around base mounting.
3. Stop engine and check oil level.

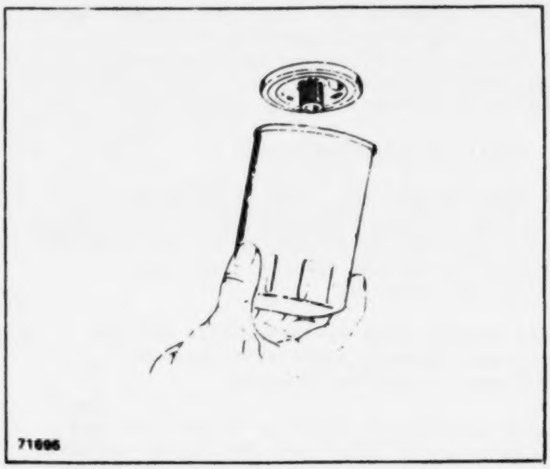


Figure 3-1. Oil Filter Removal

TOPIC 4. OIL PRESSURE RELIEF VALVE

A. DESCRIPTION

Pressure relief is located externally on the righthand side, near the oil pan flange at the center. Pressure is controlled by a plunger and spring (Figure 4-1) the latter specificially for a certain range. The only adjustment variation is either to change springs or assemble or remove washers from behind the present spring. Up to four washers are permissible. Decrease the oil pressure by removing washers from behind the compression spring.

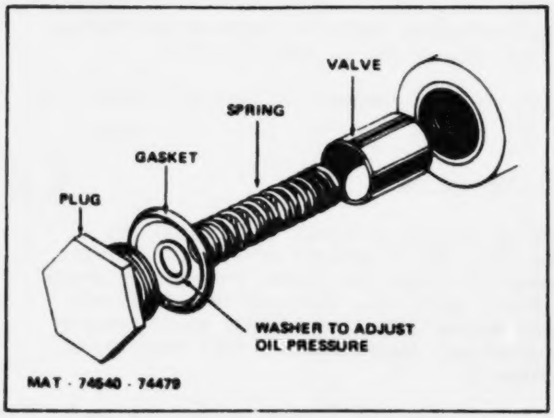


Figure 4-1. Oil Pressure Relief Valve Components

TOPIC 5. ENGINE TUNE-UP

Engine tune-up is an orderly process of restoring the engine to satisfactory performance. In addition, preventive maintenance and corrective operations should be accomplished so that engine serviceability will be unimpared. The following outlines simple adjustments, inspections and tests, and should be performed in the order given.

A. BATTERY SERVICEABILITY

Be sure that battery tray is clean and level and that battery hold-down clamps are snug. Ensure battery posts and cables are clean and free of corrosion. Apply a light coat of grease to terminals

Make certain that battery cables are not reversed. Connect negative to ground, positive to starter solenoid.

Check electrolyte level regularly, and add clean water if necessary, but do not overfill. Keep battery clean and wash with baking soda solution if corrosion is evident. Do not allow soda solution to enter cells. Inspect cables, clamps and hold-down bracket regularly. Replace if necessary.

B. INSPECT AND ADJUST SPARK PLUGS

Blow dirt from spark wells, then remove plugs. Clean spark plugs. Inspect for cracked or broken insulators, broken electrodes or excessive carbon deposits. Replace any faulty plugs. Adjust gap to specifications.

Test cylinder compression before reinstalling plugs.

C. COMPRESSION

Warm up engine to operating temperature. **Blow dirt out of pockets around spark plugs. Remove all plugs and insert compression gauge in first spark plug hole and hold it firmly. Crank engine until the highest gauge reading is obtained. (Approximately four compression strokes.)**

Check all cylinders in this manner. If readings are low in two adjacent cylinders, a blown head gasket is indicated. If readings are low and vary widely (more than 10 PSI), pressure is being lost either at the pistons, rings or valves. To determine where pressure loss is occurring, insert about one tablespoon of SAE 30 engine oil through the spark plug hole. Take a new reading. If this reading is higher than the initial reading, the piston rings are faulty. If reading is the same as the initial reading, the valves may be leaking or the cylinder head gasket is damaged.

D. CYLINDER LEAK TEST

Perform cylinder leak test by removing one spark plug at a time, (ensure high tension coil wire is disconnected) and insert leak tester in spark plug well; build up pressure as recommended. Record reading and record any appreciable pressure fall-off. If pressure loss is indicated, check cylinder head for hissing noise, (head gasket), carburetor, (intake valve), exhaust pipe and manifold, (exhaust valve), and oil fill tube, (piston rings). Check all cylinders in like manner and repair as required.

E. IGNITION TIMING

The ignition system consists of the battery, ignition coil, distributor, condenser, spark plugs, alternator and high and low tension wiring.

The system produces and delivers high voltage surges of up to 20,000 volts to the correct plug, at the correct intervals in exact time with the engines' sequential mechanism.

To maintain efficient, economical engine operation, the electrical and mechanical sequencing must be exactly matched or timed.

The distributor warrants particular attention in relation to this sequencing and the following procedure is recommended as a comprehensive alignment:

1. **At 500 hour intervals, remove the distributor cap and dust seal and inspect contact points, rotor and cap for evidence of wear, arcing, cracks or corrosion. Repair or replace as required. Label spark plug wires for correct installation.**

2. **Pitted or burned points must be replaced.**

NOTE: If points are burned or pitted, replace the condenser, too.

3. **The distributor may be removed for servicing or replacement at this time.**

NOTE: When the distributor is removed and replaced, the original position of the distributor must be observed. Refer to ELECTRICAL SYSTEM MANUAL for proper removal and replacement procedures.

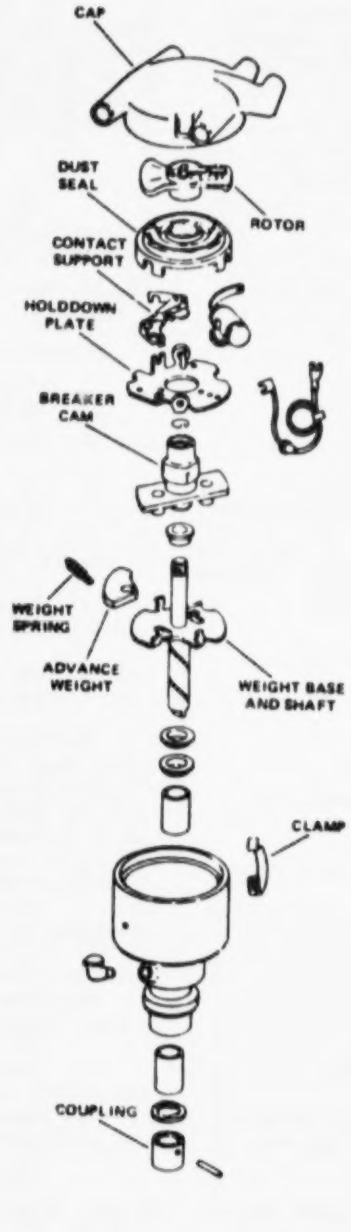

CAP
DUST SEAL
ROTOR
CONTACT SUPPORT
HOLDDOWN PLATE
BREAKER CAM
WEIGHT SPRING
ADVANCE WEIGHT
WEIGHT BASE AND SHAFT
CLAMP
COUPLING
780831

Figure 5-2. Distributor Assembly (Type II) Exploded View

4. Refer to paragraph I for static ignition timing and paragraph J for dynamic ignition timing.

5. If distributor is not going to be removed, install contact set, if removed. Be certain that points are in perfect alignment (Figure 5-3 and 5-4).

> NOTE: Following data is required for proper distributor to engine timing.

F. DISTRIBUTOR CHARACTERISTICS

Type II Distributor

Rotation .... C.C.W. (Viewing Rotor)
Point Opening .... .020"
Cam Angle Range .... 66° - 72°
Start Advance (T.D.C.) .... 500 RPM

G. STATIC BREAKER POINT ADJUSTMENT

NOTE: Refer to paragraph F for correct point gaps and cam angles for the distributor being serviced.

1. Nudge the starter switch until the breaker arm is resting on the high point of the cam. Attach a remote starter switch between the battery positive (+) terminal and the starter solenoid switch terminals. The truck starter switch can be used but a remote switch is more convenient.

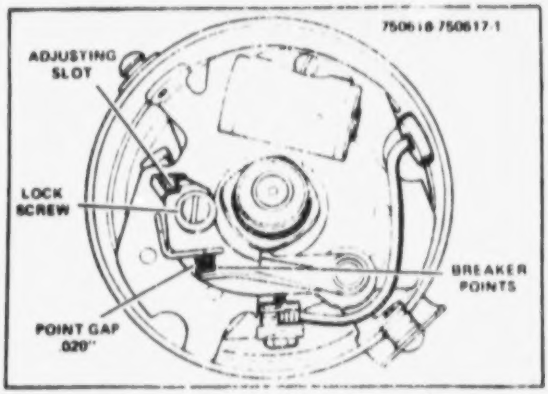


Figure 5-4. Adjusting Contact Gap (Type II Distributor)

2. Slightly loosen the contact assembly locking screw (Figure 5-3 and 5-4).
3. Insert a feeler gauge between the contact points, insert a screwdriver in the adjusting slot and turn clockwise or counterclockwise to specified point gap. When properly adjusted a slight drag will be felt when feeler gauge is slid between the points.
4. Tighten locking screw and recheck gap for accuracy.

5. Replace dust seal, rotor and distributor cap.

H. DYNAMIC BREAKER POINT ADJUSTMENT

1. Disconnect high tension coil lead from distributor and ground to engine or frame.

2. Attach positive lead of dwell meter to the negative terminal (-) of coil. Connect negative dwell meter lead to ground.

3. Attach a remote starter switch between the battery positive terminal (+) and the starter solenoid terminal. The truck starter switch can be used but the remote switch is more convenient.

4. Remove distributor cap, rotor and dust seal. Slightly loosen the contact assembly locking screw and insert a screw driver in the adjusting slot (Figure 5-3 or 5-4).

5. Use starter to crank the engine. Observe the dwell meter. The meter will rise to a value and then drop off each time the points open. Turn the screwdriver in the adjusting slot until the maximum value of the needle rise equals the required dwell specification. See paragraph F.

6. Tighten the contact assembly locking screw.

7. Install dust seal, rotor and cap.

8. Start engine and recheck dwell reading on meter. Needle should now hold steady at specified dwell angle. If so, remove dwell meter and remove remote switch. If not, repeat procedure starting with item 4 above.

I. STATIC IGNITION TIMING

The exact timing of the spark depends on the actual breakage, or opening, of the electrical contact across the points. Should there be any question as to the accuracy of point setting relative to the engine timing mark, the use of one of the following methods is recommended.

1. Make up a simple light circuit consisting of an automotive light bulb with soldered on leads or a socket with lead wires attached.

2. Remove distributor cap, rotor and dust seal. Ensure that distributor point gap is properly set. See specifications for distributor.

3. Loosen distributor clamp (Figure 5-6).

4. Remove timing window cover on flywheel housing and remove the spark plug from number one cylinder.

5. Place thumb over spark plug opening and rotate engine crankshaft by hand until outward pressure against thumb is felt. Continue turning crankshaft until D.C. mark (Figure 5-5) is aligned with timing pointer at center of timing window.

6. Clip one lead to positive, or ungrounded, side of the battery. Attach the other lead to the primary wire connection on the side of the distributor (Type I) or the distributor coil negative terminal (Type II).

7. Hold rotor against rotation. Rotate distributor slowly in the direction of rotation until test lamp just lights. Now start the adjustment.

8. Very slowly turn the distributor housing against the direction of shaft rotation until the test lamp goes out. Stop immediately. Do not pass this point or turn the distributor housing back and forth to locate it.

9. Should you turn the housing too fast or too far beyond the point where the light goes out, turn back to the original position and repeat the procedure.

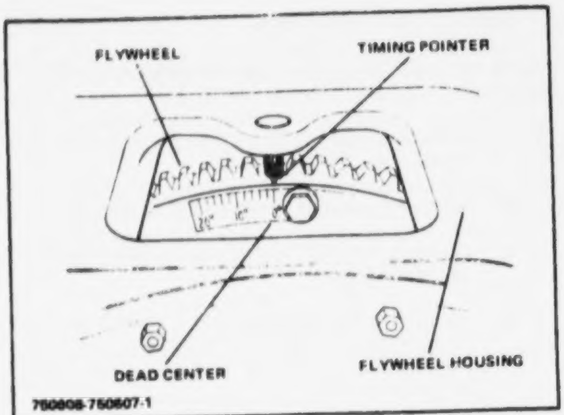


Figure 5-5. Flywheel Timing Marks

10. When you have located the distributor in the proper position (with test lamp out) tighten distributor hold down clamp.

11. With the test lamp still connected, check for proper setting by releasing tension on rotor.

    a. With rotor held against rotation, light should go out.

    b. With rotor released, test lamp should be on.

12. Remove test lamp. Replace dust seal, rotor and distributor cap.

13. Install spark plug.

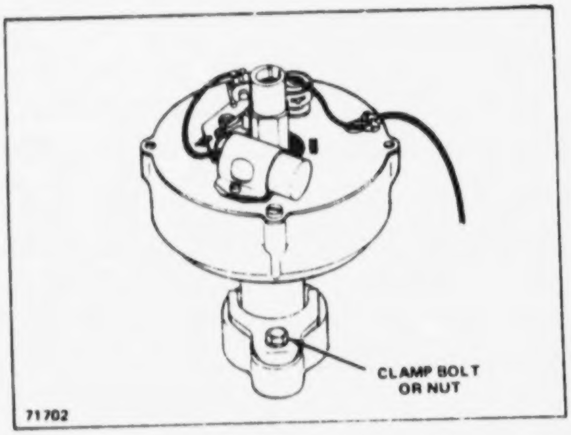


Figure 5-6. Distributor Timing Adjustment (Typical)

J. DYNAMIC IGNITION TIMING

Ensure distributor point gap is properly set. (Refer to Ignition Timing above.)

1. Loosen clamp at the distributor only if required. (Figure 5-6).
2. Remove flywheel inspection cover.
3. Connect timing light per manufacturer's instructions.
4. Install a tachometer and connect positive lead to negative ignition coil terminal and connect the negative lead to ground.
5. Start engine and using carburetor idle adjusting screw, lower idle speed to 400 to 450 rpm so that the automatic advance of the distributor is fully retarded. THIS IS VERY IMPORTANT TO OBTAIN CORRECT TIMING.
6. Direct timing light at flywheel timing hole. If timing light strobe does not show perfect alignment of D.C. mark with timing pointer, loosen distributor clamp and turn distributor until it does. To advance timing, turn distributor clockwise. To retard timing, turn distributor counterclockwise.
7. Lock distributor in this position.
8. Accelerate the engine a few times and observe movement of D.C. mark after engine returns to 400 to 460 rpm.
9. If spark advance is functioning properly the D.C. mark will move counterclockwise during acceleration and move back to D.C. alignment at engine idle speed. Reset engine idle speed.
10. Shut engine off. Remove tachometer and timing light. Install flywheel inspection cover.

NOTE: If lift truck is equipped with an oil clutch transmission use static ignition timing only to time engine.

K. GENERAL INSPECTION

1. Clean fuel filter.

   Remove and clean fuel filter bowl. Clean screen in filter head. Refer to Fuel System.

2. Clean air cleaner.

   Clean air cleaner element and cleaner. Refer to Fuel System.

3. Adjust valve clearances.

   Inspect and adjust valve clearances. Refer to Valve Clearance Adjustment.

4. Adjust carburetor.

   With all the above operations completed, start engine and operate until hot. Adjust carburetor. Refer to Fuel System.

TOPIC 6. TROUBLESHOOTING

It has been proven that over 90% of the troubles that occur in engine operation are avoided when those persons responsible for maintenance adhere to an adequate program of lubrication, inspection and maintenance on a regularly scheduled basis. The time and expense involved in such programs is only a fraction of that incurred when poor maintenance practice results in a major malfunction or breakdown.

In most cases, when trouble is detected and remedied immediately, a more expensive, time consuming repair will be avoided. Following are some of the normal complaints encountered in routine operation and the probable causes.

For detailed inspection, maintenance and repair procedures, refer to the specific topical section, repair manual, relating to the malfunctioning component.

TROUBLESHOOTING CHART

TROUBLE	PROBABLE CAUSE	POSSIBLE SOLUTION
Engine will not start.	Weak or dead battery.	Charge or replace battery.
	Poor ground connection.	Clean and tighten ground connection.
	Faulty starting switch or solenoid on starting motor.	Repair or replace switch and/or solenoid.
	Internal engine seizure.	Turn engine manually to determine cause. Repair engine.
Engine cranks but will not start.	Defective wiring or spark plugs.	Replace plugs or wiring.
	Points not gapped properly or defective.	Adjust points or replace points.
	Defective wiring.	Replace wiring.
	Defective ignition switch.	Replace switch.
	Defective coil.	Replace coil.
	Defective distributor cap or rotor.	Repair distributor.
	No gas in fuel tank.	Fill tank.
	Clogged filter or lines.	Clean filter and lines.
	Defective fuel pump.	Replace fuel pump.
	Tank vent plugged.	Clean vent.
	Carburetor flooded	Too much choking.
	Carburetor float level improperly set.	Repair carburetor.
	Defective choke.	Repair choke.

TROUBLE	PROBABLE CAUSE	POSSIBLE SOLUTION
Engine misfires.	Uneven compression.	Check compression and adjust or grind valves.
	Wet or deteriorated high tension wires.	Dry wires. Replace defective wires.
	Defective spark plugs.	Replace spark plugs.
	Cracked distributor cap.	Replace cap.
	Points not gapped properly or defective.	Repair distributor.
	Engine not properly timed.	Time engine.
Engine runs unevenly at idle speed.	Spark plugs not gapped properly.	Gap or replace spark plugs.
	Idle adjustment on carburetor not properly set.	Adjust carburetor idle.
	Wrong float level	Repair carburetor.
	Carburetor or intake manifold leaking.	Repair carburetor or replace manifold gasket.
	Cylinder head gasket leaking.	Replace gasket.
	Valves out of adjustment or damaged.	Adjust or replace valves.
Engine misfires at high speed.	Points not properly adjusted.	Adjust points.
	Distributor breaker arm spring defective.	Replace spring.
	Valve springs weak or broken.	Replace valve springs.
	Spark plugs not gapped properly or incorrect plugs.	Adjust spark plug gap or replace plugs.
Engine backfires.	Improper timing.	Time engine.
	Air cleaner dirty or clogged.	Service air cleaner.
	Fuel line bent or plugged.	Clean or replace fuel line.
	Carburetor dirty.	Clean carburetor.
	Valves sticking.	Repair valves.
	Weak or broken valve springs.	Replace springs.
Engine pings excessively.	Too low of gas octane rating.	Fill with proper grade of gas.
	Incorrect engine timing.	Time engine.

TROUBLE	PROBABLE CAUSE	POSSIBLE SOLUTION
Engine idles too fast.	Carburetor not properly adjusted.	Adjust carburetor idle.
	Governor not properly adjusted.	Adjust governor.
	Throttle not adjusted properly or return spring is weak.	Adjust throttle or replace spring.
Engine dies when at idle speed.	Improper idle adjustment.	Adjust carburetor idle.
	Carburetor dirty.	Clean carburetor.
	Choke not properly adjusted.	Adjust choke.
	Air leaks in manifold.	Check and correct.
Engine stumbles on acceleration.	Carburetor out of adjustment.	Adjust carburetor.
	Governor not adjusted properly.	Adjust governor.
	Dirty carburetor.	Clean carburetor.
	Air in fuel lines.	Check and clean fuel lines.
Engine lacks power.	Poor compression.	Adjust or grind valves.
	Improper timing.	Time engine.
	Throttle not adjusted properly.	Adjust throttle.
	Air leak in fuel system.	Check and correct.
	Air cleaner restricted.	Service air cleaner.
	Exhaust system restricted.	Repair exhaust system.
	Incorrect grade of gasoline.	Fill with proper grade of gasoline.
	Valves not adjusted properly.	Adjust valves.
	Piston rings sticking or worn.	Repair engine.
Engine overheats.	Coolant level low.	Replenish coolant.
	Radiator clogged or leaking.	Clean, repair or replace radiator.
	Fan belts slipping.	Adjust belt tension.
	Thermostat sticking or defective.	Replace thermostat.
	Improper engine timing.	Time engine.
	Exhaust system clogged or defective.	Repair exhaust system.

TROUBLE	PROBABLE CAUSE	POSSIBLE SOLUTION
Engine overheats. (cont'd)	Water pump defective.	Repair or replace water pump.
	Engine overloaded.	Check loading and reduce as necessary.
Low oil pressure.	Low oil level.	Refill crankcase.
	Defective oil pressure gauge or pressure sender.	Repair or replace gauge and/or sender.
	Incorrect grades of oil.	Drain and refill with correct grade.
	Oil pump suction screen clogged.	Clean screen.
	Dirty or defective relief valve.	Clean or repair relief valve.
	Defective oil pump.	Repair or replace oil pump.
	Worn bearings.	Replace bearings.
	Worn camshaft bushings.	Replace bushings.
Oil pressure to high.	Incorrect grade of oil.	Drain and refill crankcase with correct grade of oil.
	Defective or damaged relief valve.	Repair or replace relief valve.
	Oil lines or galleries plugged.	Overhaul engine.
	Oil pressure gauge defective.	Replace gauge.
Engine burns oil excessively.	Leak in oil system.	Check and correct.
	Oil level too high.	Fill to proper level.
	Incorrect grade of oil.	Drain and refill with correct grade.
	Crankcase breather clogged.	Clean breather.
	Defective or damaged relief valve.	Repair or replace relief valve.
	Piston rings worn, broken or stuck.	Replace rings.
	Worn pistons and sleeves.	Replace pistons and sleeves.
	Worn bearings.	Replace bearings.
	Worn valve guides.	Replace valve guides.
Engine knocks or is noisy.	Incorrect timing.	Time engine.
	Excessive carbon buildup.	Clean cylinder head and pistons.

TROUBLE	PROBABLE CAUSE	POSSIBLE SOLUTION
Engine knocks or is noisy. (cont'd)	Poor gas.	Refill with proper fuel.
	Overloads at low operating speeds.	Check loading and correct.
	Worn main bearings or crankshaft.	Overhaul engine.
	Excessive crankshaft end play.	Correct end play to specifications.
	Worn or burned out connecting rod bearings.	Replace bearings.
	Loose or worn piston pins.	Replace pistons and pins.
	Piston loose in cylinder.	Replace piston and/or sleeve.
	Broken piston ring.	Replace piston rings.
	Burned valves or seats.	Replace valves and or seats.
	Weak or broken valve springs.	Replace springs.
	Valves sticking.	Repair or replace valves.
	Tappets worn or out of adjustment.	Replace or adjust tappets.
	Loose or worn camshaft bearings.	Replace camshaft bearings.
	Excessive camshaft end play.	Adjust end play or replace camshaft.
	Gears in gear train worn or loose.	Repair or replace gear train.
	Engine not aligned with transmission or pump.	Align engine.
	Loose, bent, or off center coupling.	Repair or replace coupling.
	Engine not securely mounted.	Tighten engine mountings.
	Flywheel out of balance.	Repair or replace flywheel.

TOPIC 1. FUEL SYSTEM

A. DESCRIPTION

The following components make up the fuel system: The fuel tank, fuel pump, strainer and filter, the carburetor, accelerator linkage and the governor assembly.

The fuel tank is the fuel reservoir and, via the fuel lines, fuel pump, strainer and filter, supplies the carburetor with raw fuel to be vaporized and mixed with fresh air for controlled combustion.

The fuel system is designed to function virtually trouble free, but does require adequate preventive maintenance to ensure its continued operation.

TOPIC 2. AIR CLEANER

A. DESCRIPTION

The air cleaner is mounted on the side of the engine and is connected to the carburetor air intake by tubing and hose. It prevents dust, chaff, or other foreign matter, the chief causes of engine wear, from entering the manifold and engine.

The air enters the cleaner and passes through a replaceable type, dry filter element. The element is constructed of pleated paper and bound at the edges with plastic. This construction filters and removes the fine dust particles from the air stream intake. The clean and purified air is then drawn through the center tube of the element and into the carburetor and intake manifold. For continued efficient engine operation, the air cleaner must be properly serviced.

B. INSPECTION

Inspect the filter element at intervals frequent enough to ensure having a clean element. It may become necessary to inspect the element more often in an atmosphere heavily laden with dust, chaff and lint.

C. SERVICE

When servicing the cleaner, reduce engine down time to a minimum by replacing a dirty filter element with a new element or one that has been cleaned. Service the dirty element later, using procedures detailed in Subparagraph 2 (Optional Service Methods).

⚠ CAUTION

Never remove the air cleaner while engine is running, and do not run engine unless air cleaner is in place.

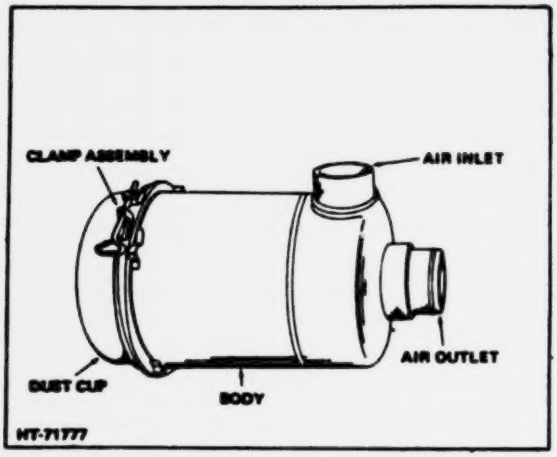


Figure 3-1. Air Cleaner

1. Air Cleaner Service

   Clean baffle and dust cup as follows:

   a. Loosen clamp assembly (Fig 3-2) and remove dust cup.

   b. Loosen wing nut and remove baffle from dust cup.

   c. Empty dirt from cup. Clean cup and baffle.

   d. Remove foreign material from around filter element.

   e. Assemble baffle to dust cup. Tighten wing nut.

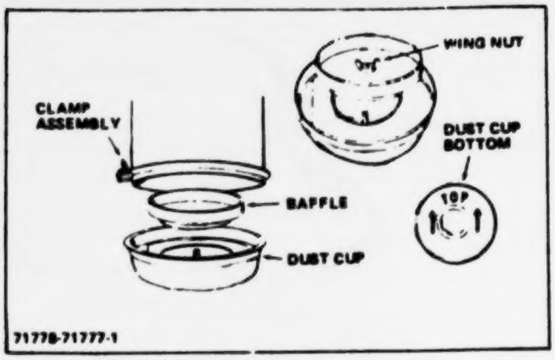

WING NUT
CLAMP ASSEMBLY
DUST CUP BOTTOM
TOP
BAFFLE
DUST CUP
71778-71777-1

Figure 3-2. Baffle and Dust Cup Details

CAUTION

Bottom of dust cup is marked with arrows and the word TOP. Air cleaner is mounted in horizontal position. Be sure dust cup arrows point up (Fig 3-2). DO NOT USE OIL IN DUST CUP.

f. Position dust cup on air cleaner body. Tighten clamp securely.

Replace filter element as follows:

a. Remove wing screw and gasket washer. Remove filter element.

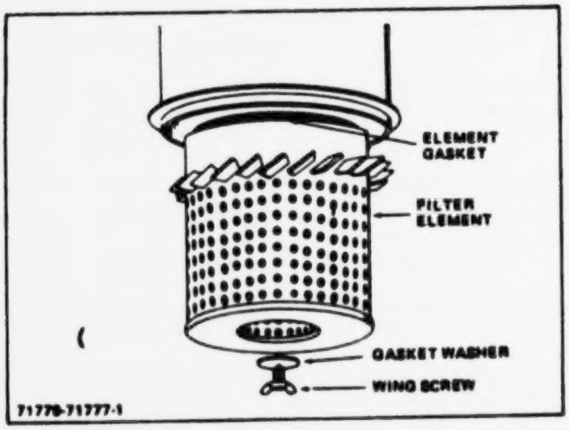

ELEMENT GASKET
FILTER ELEMENT
GASKET WASHER
WING SCREW
(
71779-71777-1

Figure 3-3. Removing Filter Element

b. Inspect element gasket for damage.

c. Install a new or clean element. Inspect cup gasket (if applicable) and replace if it is damaged.

CAUTION

Air cleaner is mounted in horizontal position. Be sure dust cup arrows point up. (See Fig 3-2) DO NOT USE OIL IN DUST CUP. Always refer to manufacturer's instructions on air cleaner.

d. Install dust cup on air cleaner body. Make certain it seals 360 degrees around the body. Tighten clamp securely.

2. Optional Service Methods

CAUTION

Pre-cleaning fins on filter element are not removable.

CAUTION

Air pressure at nozzle must not exceed 100 psi. Maintain reasonable distance between nozzle and filter element.

The filter element can be either dry cleaned or washed as detailed below.

a. To dry clean filter element, direct a jet of dry clean air up and down pleats on clean air side of element.

b. If filter element is oily and soot laden, wash it in a solution of warm water and household detergent. The warmer (100°F) the solution, the better it will clean. Soak element for 15

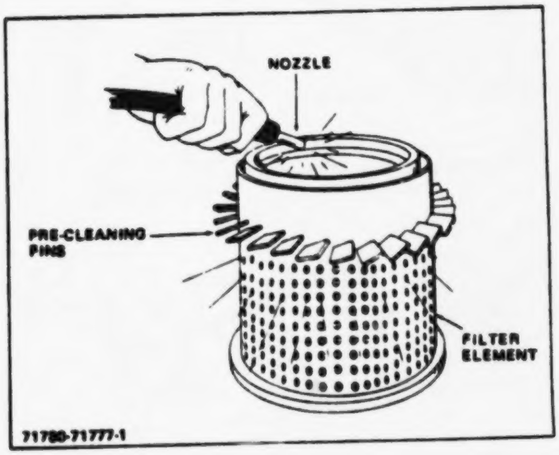

NOZZLE
PRE-CLEANING FINS
FILTER ELEMENT
71780-71777-1

Figure 3-4. Dry Cleaning Filter Element

minutes, then remove it and rinse thoroughly with clean, running water (maximum pressure 10 psi). Air dry thoroughly before reusing. (A fan or air draft may be used for drying, but do not heat element to hasten drying.)

c. Inspect for damage by placing a bright light inside element (Fig 3-5). Thin spots, pin holes or the slightest rupture will render the element unfit for further use.

NOTE: Replace filter element after 6 cleanings.

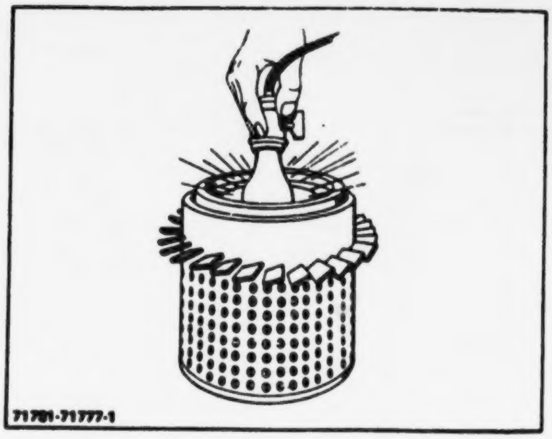


Figure 3-5. Inspecting Filter Element

TOPIC 4. FUEL TANK

A. DESCRIPTION

The fuel tank is of steel construction with welded seams. It includes a fuel level sender unit and a filler cap with filter screen.

The fuel tank requires little, if any service other than periodic cleansing of the fuel filter screen.

B. CLEANING AND INSPECTION

1. Remove filler cap assembly and check filter screen for fouling. Clean if required, and dry with compressed air.
2. Replace filler cap assembly.
3. Loosen drain plug.
4. Inspect for water contamination.
5. If contaminated, drain until water is emptied, then close valve.
6. Connect outlet fuel line and fill tank to recommended capacity with proper octane fuel.
7. Check tank and fuel lines for leaks. Repair if necessary.

TOPIC 5. FUEL PUMP AND FUEL FILTER

A. DESCRIPTION

The fuel pump is a mechanical diaphragm type pump with a strainer and sediment bowl. The pump is mounted on the left side of the engine and is operated by an eccentric cam on the engine camshaft.

Fuel from the tank enters the strainer-sediment bowl on the suction stroke of the pump and is forced to the carburetor on the pressure stroke. Action is controlled by two valves in the cover assembly.

B. REMOVAL AND INSPECTION

1. Disconnect fuel pump inlet and outlet lines.
2. Remove capscrews and lockwashers from fuel pump mounting flange and remove pump.
3. Clean pump with solvent and dry with compressed air.
4. Remove bowl and bowl gasket.
5. Remove strainer screen from top cover and discard.
6. Install new strainer screen after ensuring that it shows no damage or obstruction. New screen must fit snugly around inner and outer edges.
7. Install new bowl gasket, swing bail assembly into position over bowl, and tighten nut securely.
8. Test operation of pump valve by attaching pressure gauge to outlet and operating rocker arm. Pressure should be between 2-3/4 p.s.i. to 3 p.s.i. Pressure should not fall off rapidly.
9. Install fuel pump as removed, ensuring new mounting gasket is used.
10. Install and secure capscrews and lockwashers.
11. Connect inlet and outlet fuel lines. Do not over tighten connections.

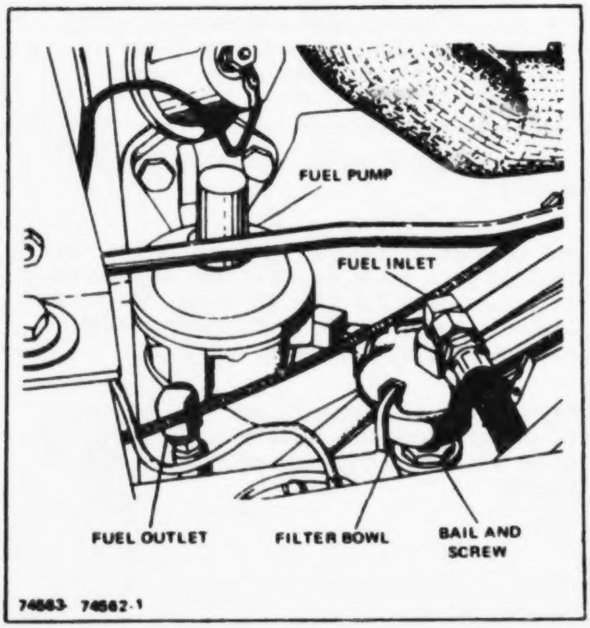


Figure 5-1. Pump Mounting

TOPIC 6. CARBURETOR

A. DESCRIPTION

The carburetor used in this fuel system is a single venturi, updraft type with fixed jets covering all speeds except idle. It has an airbleed well method of compensation, an idle fuel adjusting screw and an idle throttle stop screw. The air intake of the carburetor is provided with a choke valve control. The flow of fuel through the main jet system is controlled by the size of the jet. The idle adjusting screw controls the fuel mixture for the idle system.

B. CHOKE VALVE ADJUSTMENT

To aid in starting a cold engine, a choke valve is provided in the air inlet of the carburetor. By closing this valve, a rich mixture of fuel is drawn into the carburetor for quick starting.

It is only necessary to make certain the choke control fully opens the valve by the time the engine has reached normal operating temperature and choke control button is pushed all the way in. Adjustment is made at the swivel connection on the choke shaft lever.

C. CARBURETOR ADJUSTMENTS

NOTE: Before any work is performed on carburetor, make sure the trouble is not due to poor compression, or in the ignition system due to incorrect timing, fouled spark plugs, burned ignition points, etc.

Refer to REPAIR MANUAL for CARBURETOR REPAIR.

The correct mixture of fuel and air is controlled by a fixed main jet and an adjustable idle fuel jet. The idle throttle stop screw controls the throttle position to ensure correct engine idle speed.

Adjustments are properly set when the unit is shipped from the factory and if they have to be disturbed the carburetor must be readjusted.

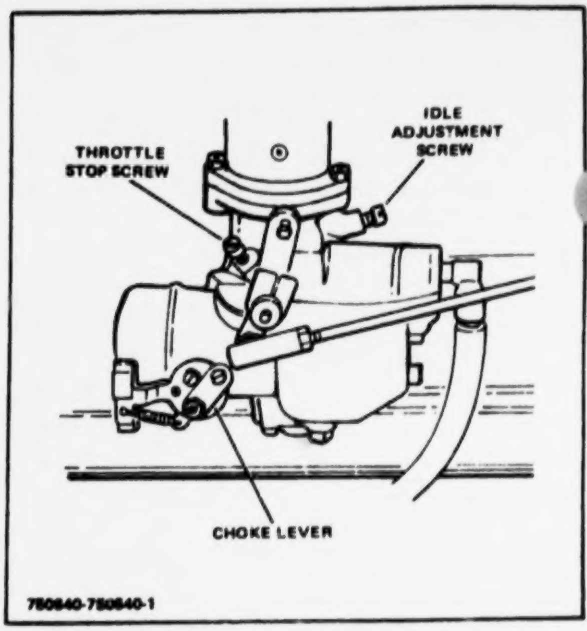


Figure 6-1. Carburetor

NOTE: Before making any carburetor adjustments, allow the engine to warm up to normal operating temperature.

Make carburetor adjustments as follows:

1. Throttle stop-screw adjustment: The throttle idling stop-screw should be turned in against the stop to hold the throttle open slightly. Then, after the idle fuel adjustment is made, adjust the stop-screw to obtain an idle speed of between 500 and 550 r.p.m.

2. Idle fuel adjustment: Turn idle adjustment screw in to obtain a lean mixture or turn out to obtain a rich mixture. During adjustment, engine speed may increase or decrease. Adjust idle screw until the engine runs smoothly and steadily. It may be necessary to reset throttle stop-screw to obtain correct idle speed.

TOPIC 7. ACCELERATOR LINKAGE

A. DESCRIPTION

The accelerator linkage provides manual, foot pedal control of the engine speed by either increasing or decreasing the fuel flow to the carburetor. Maximum engine speed, RPM, is controlled by the governor assembly, which is pre-adjusted at the factory.

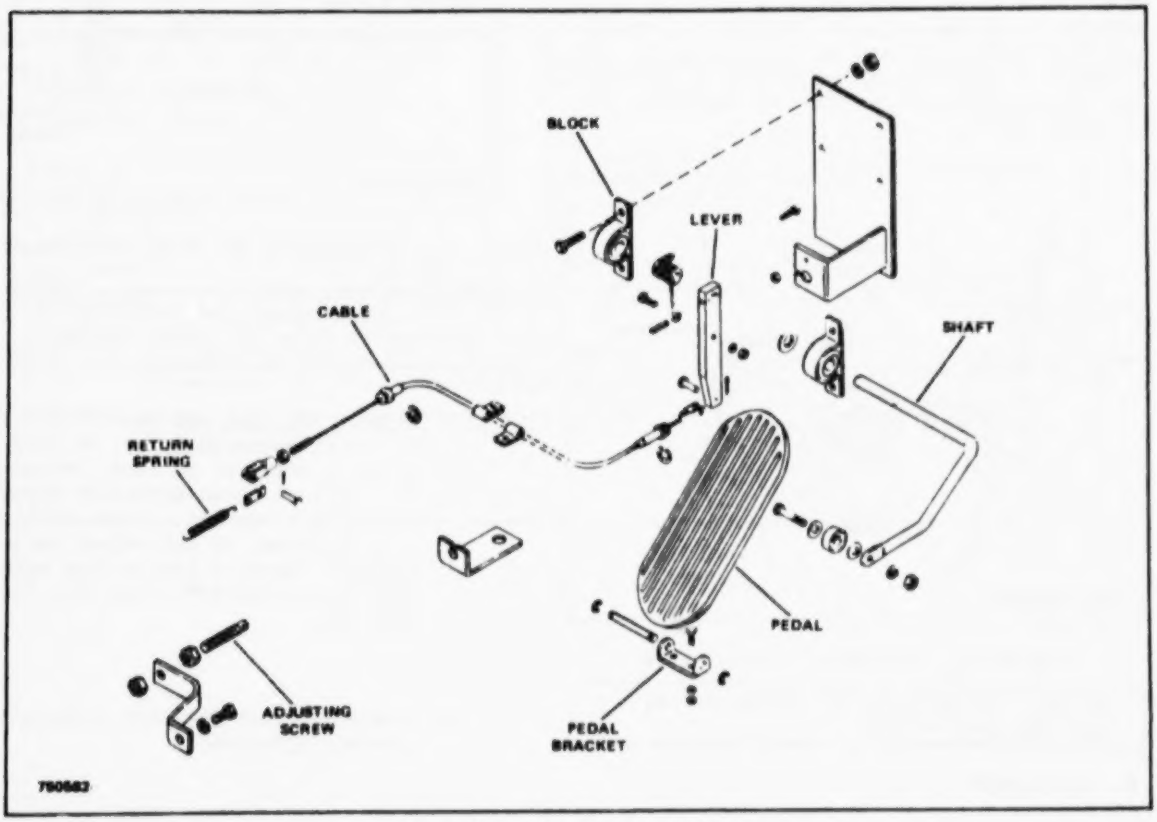

BLOCK
LEVER
CABLE
SHAFT
RETURN SPRING
PEDAL
ADJUSTING SCREW
PEDAL BRACKET
750683

Figure 7-1. Accelerator Linkage

TOPIC 8. GOVERNOR (TYPE II)

A. DESCRIPTION

A camshaft gear governor (Fig. 8-1) is used on the engine. The governor is a variable speed type and is sealed, dust proof and engine lubricated. A control shaft floats on two needle bearings mounted in the front cover. Close, accurate control of speed is provided through the complete power range. A idle surge adjustment screw provides pressure against the race assembly to eliminate any tendency of the engine to surge.

The governor consists of ten hardened steel balls riding in races in the driver assembly located in the camshaft gear. The driver assembly is locked to the camshaft with a lock nut. A gear on the crankshaft drives the camshaft gear. As the camshaft gear rotates the balls are forced outward by centrifugal force and against the race assembly. When the engine speed increases this force increases until a balanced condition between the governor rod spring and the governor lever exists. This action holds the engine at a constant speed.

The governor spring (Fig. 8-2) applies tension to the governor lever to force it toward the open throttle or increased speed position. This tension is counteracted by the balls in the governor acting against the race assembly. Adjustment is obtained by increasing or decreasing the tension the governor spring imposes on the governor lever.

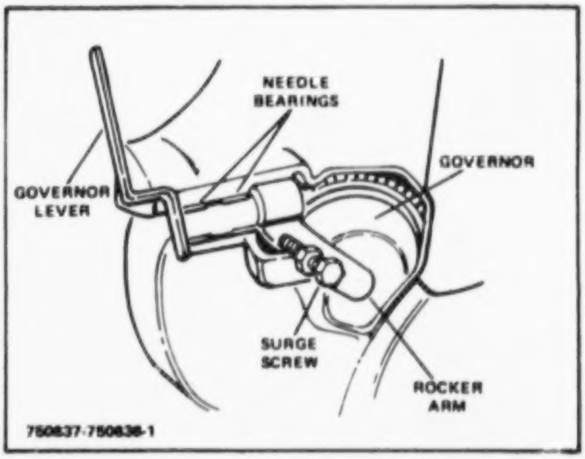


Figure 8-1. Governor - Cutaway View

WARNING: DISCONNECT FAN BEFORE MAKING GOVERNOR ADJUSTMENTS.

B. ADJUSTMENT

The governor should be adjusted to maintain a high idle speed of 2650 to 2700 engine RPM.

1. Start engine and run until engine reaches normal operating temperature.
2. With choke completely open, back out surge adjusting screw (Fig. 8-2) so it will have no effect.
3. With engine idling under no load loosen lock nut on eyebolt holding governor spring to bracket. Turn lower nut counterclockwise to increase idle speed and clockwise to decrease speed.
4. When speed is adusted to correct rpm, tighten lock nut.

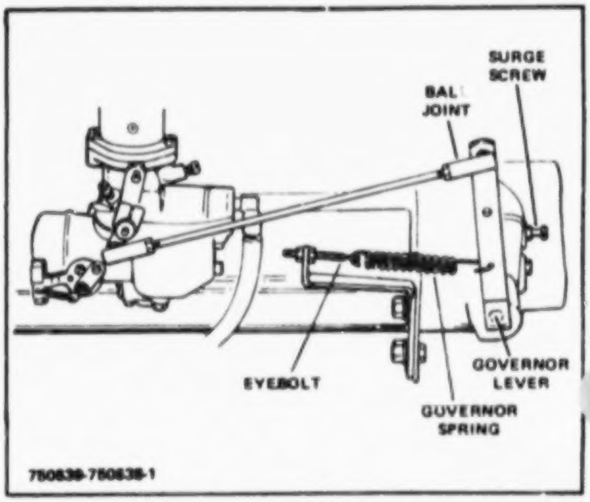


Figure 8-2. Governor Adjustment

NOTE: For removal and installation procedures refer to ENGINE REPAIR.

5. Release the load and depress accelerator to run at governed speed, no load. If a surge is noted at no load, loosen lock nut and turn surge adjusting screw clockwise a turn at a time until surge is eliminated. Do not adjust surge screw to increase the no load speed more than a few RPM if at all. Tighten lock nut.
6. Check all lock nuts and tighten to hol correct adjustment.

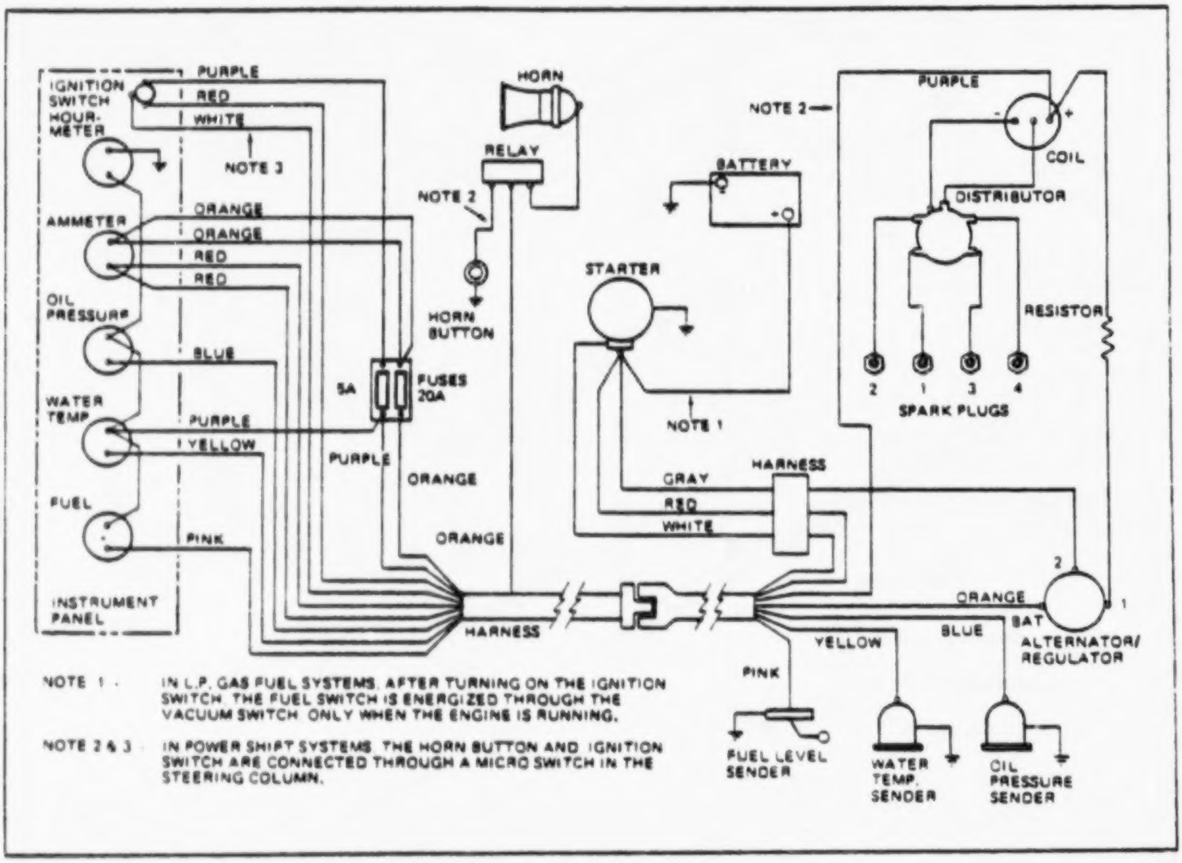
TOPIC 1. ELECTRICAL SYSTEM

A. DESCRIPTION

The electrical system includes the battery, alternator with integral voltage regulator, spark plugs, starter motor solenoid and starter motor, associated wiring and accessories. The electrical gauges and the horn are protected by fuses conveniently located underneath the instrument panel.

The instrument panel and engine, chassis and accessory wiring groups are all neatly bundled in a common wiring harness to protect wiring from moisture, grease and possible damage due to inadvertent contact with frame or linkage.

A typical electrical wiring diagram is illustrated in Figure 1.


IGNITION SWITCH
HOUR-METER
AMMETER
OIL PRESSURE
WATER TEMP
FUEL
INSTRUMENT PANEL
PURPLE
RED
WHITE
NOTE 3
ORANGE
ORANGE
RED
RED
BLUE
PURPLE
YELLOW
PINK
HORN
RELAY
NOTE 2
HORN BUTTON
5A
FUSES 20A
PURPLE
ORANGE
ORANGE
HARNESS
BATTERY
STARTER
NOTE 1
GRAY
RED
WHITE
HARNESS
NOTE 2
PURPLE
COIL
DISTRIBUTOR
RESISTOR
2
1
3
4
SPARK PLUGS
2
ORANGE
BAT
1
BLUE
YELLOW
ALTERNATOR/ REGULATOR
PINK
FUEL LEVEL SENDER
WATER TEMP. SENDER
OIL PRESSURE SENDER

NOTE 1 - IN L.P. GAS FUEL SYSTEMS, AFTER TURNING ON THE IGNITION SWITCH, THE FUEL SWITCH IS ENERGIZED THROUGH THE VACUUM SWITCH ONLY WHEN THE ENGINE IS RUNNING.

NOTE 2 & 3 - IN POWER SHIFT SYSTEMS, THE HORN BUTTON AND IGNITION SWITCH ARE CONNECTED THROUGH A MICRO SWITCH IN THE STEERING COLUMN.

Figure 1. Electrical Wiring Diagram

TOPIC 2. BATTERY

A. DESCRIPTION

A 12-volt battery, mounted in a steel tray under the rear deck plate, is held securely in place by a hold-down clamp. Electrical energy drained from the battery, through operation of

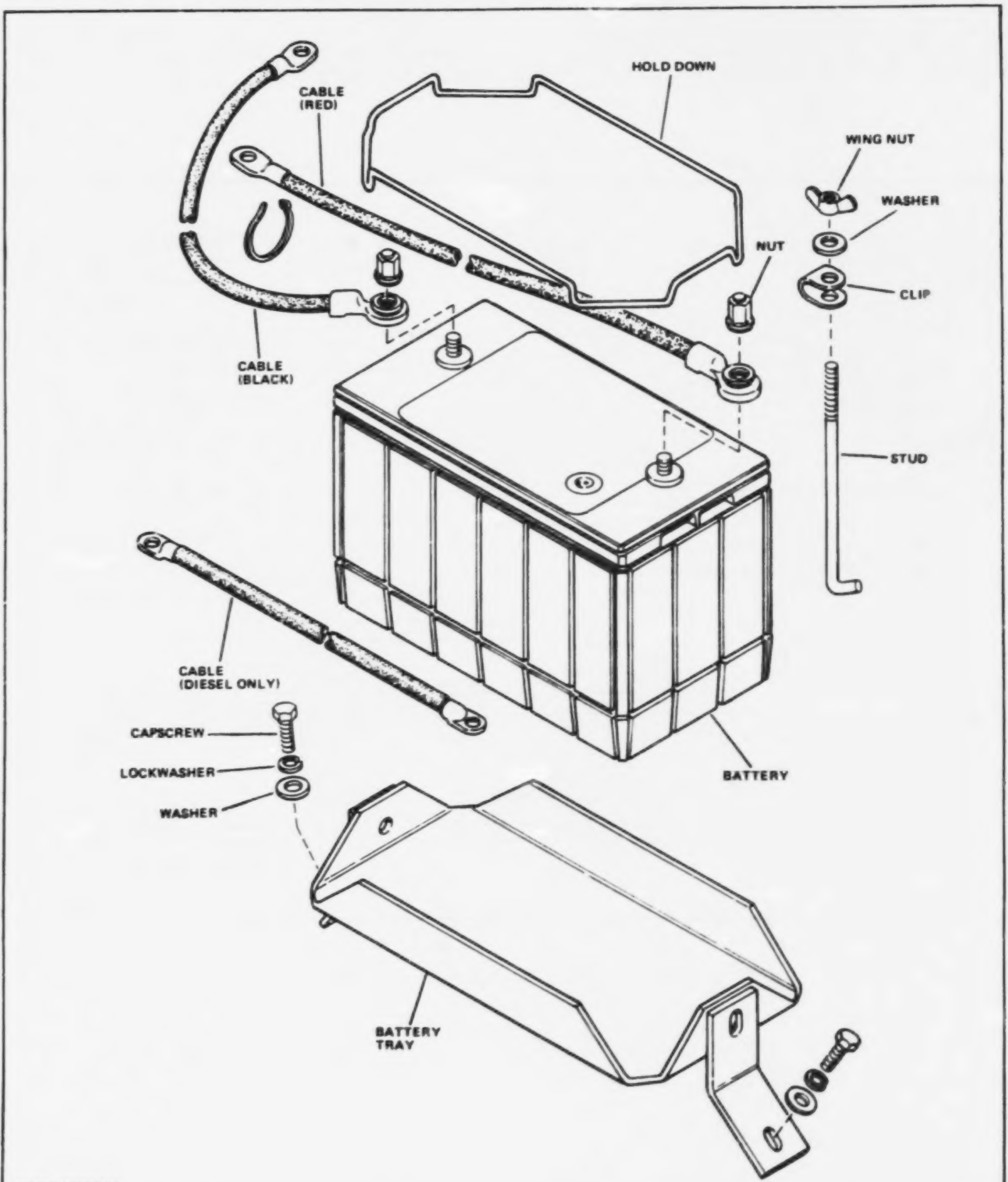

HOLD DOWN
CABLE (RED)
WING NUT
WASHER
NUT
CLIP
CABLE (BLACK)
STUD
CABLE (DIESEL ONLY)
CAPSCREW
LOCKWASHER
WASHER
BATTERY
BATTERY TRAY
770518-770288-1

Figure 2-1. Battery and Components

various units in the system, is restored by the regulated alternator.

B. SERVICE

1. The battery is a sealed unit, requiring no electrolyte testing or addition of water. A charge state indicator is provided as part of the battery. It is located near the positive (+) terminal.

   Battery mounting is as shown in Figure 2-1, with the battery positive post connected to the cable leading to the starter solenoid; while the negative post is connected to ground on the engine block.

2. Check external condition of battery terminals and battery cables. Top of battery should be kept clean and the battery hold-down clamp should be properly secured. If the top of the battery is dirty and/or corroded, it should be cleaned with a strong soda solution and a soft bristled brush. After foaming stops (corrosive acid dissolved) flush top of battery with clean water.

⚠ WARNING

To prevent possibility of bodily injury, always disconnect battery-to-ground cable before cleaning, repairing, or performing maintenance on the lift truck.

Battery cable terminals should always be tight on the battery posts to maintain good electrical contact. Cables should be in good condition, without broken strands or defective insulation. If battery posts and cable terminals are corroded, the cables should be removed, and the posts and terminals cleaned separately, using a strong soda solution and wire brush. Install cables and securely tighten terminals to 10-15 lb-ft of torque.

C. REMOVAL

1. Remove the rear deck plate to gain access to the battery.
2. Disconnect the positive and negative cables from their respective posts.
3. Remove the wing nuts from the hold-down studs and remove hold-down clamp.
4. Remove battery.

D. INSTALLATION

1. Maintain replacement battery in an upright position, tilting only as required for fit, during installation.
2. Be certain battery is replaced with the negative (-) post closest to the engine.
3. Make certain battery posts and cable terminals are clean. Securely connect the positive cable to the positive post and the negative cable to the negative post.
4. Do not hammer cable terminals on posts as this practice will ruin battery.
5. Tighten the cable connectors on their proper terminal posts to a torque of 10-15 lb-ft.

MEMO

TOPIC 3. ALTERNATOR AND REGULATOR

A. DESCRIPTION

Although the alternator and its built-in regulator are designed and constructed to give trouble-free service for long periods of time, following a regular inspection procedure will allow maximum life to be obtained from the units.

The inspection frequency will be determined by the type of operating conditions. High speed operation, high temperatures, and heavy duty conditions all increase wear on the alternator slip rings and bearings. The terminals should be inspected at regular intervals for corrosion or loose connections.

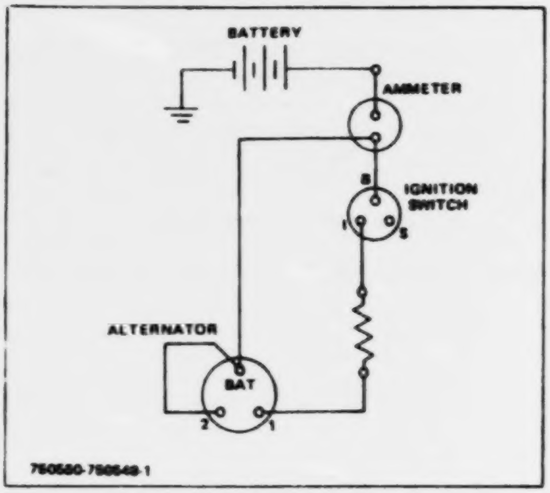


Figure 3-1. Typical Wiring Diagram

B. ADJUSTMENT

Be sure to check the mounting bolts for tightness and the belt for alignment, corrosion, tension and wear. Belt tension should be adjusted to allow approximately 3/8" inward deflection of the belt between the alternator pulley and the fan pulley with a force of about 10 pounds. (See Figure 3-2).

When tightening belt tension, always apply pressure against the stator laminations, never against the end frames.

A noisy alternator can be caused by worn or dirty bearings, loose mounting bolts, a loose drive pulley, a defective diode or a defective stator.

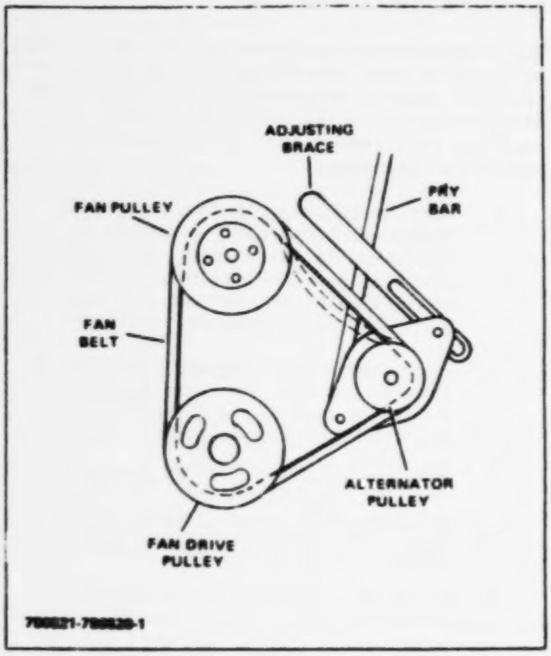


Figure 3-2. Fan Belt Tension

NOTE: For proper disassembly, inspection, repair and reassembly procedures, refer to REPAIR MANUAL.

C. REMOVAL

1. Disconnect the battery from the electrical circuit prior to alternator removal/installation.
2. Disconnect the "BAT" (battery) terminal and "#1" and "#2" post connectors at the alternator.
3. Loosen adjusting brace and mounting bolt, then push alternator towards engine until fan belt is disengaged from alternator pulley.
4. Carefully remove the alternator from the engine as the pivot mounting bolt and adjusting brace capscrew are removed.

NOTE: Refer to REPAIR MANUAL for DISASSEMBLY, INSPECTION, REPAIR AND REASSEMBLY.

D. PRECAUTIONARY PROCEDURE

The alternator is designed for use on only one polarity system; therefore, the following precautions must be observed when working on the charging circuit. Failure to heed these precautions will result in serious damage to the electrical equipment.

1. When installing alternator be absolutely sure the "BAT" terminal is connected to the ammeter. Battery positive (+) terminal must be connected to the ammeter and the negative (-) terminal to ground.
2. When connecting a booster battery, be sure to connect the negative battery terminals together and the positive battery terminals together.
3. When connecting a charger to the battery, be sure to connect the charger positive lead to the battery positive lead, the charger negative lead to the battery negative lead.
4. Be absolutely sure all connections in the circuit are secure, as the alternator must never be operated with an open circuit.
5. Never ground or short across any of the alternator terminals.

CAUTION: Refer to wiring diagrams for correct connections to alternator. Battery negative (-) terminal must be connected to ground.

E. INSTALLATION

1. Carefully position the alternator mounting flange on mounting bracket and install pivot bolt and adjusting brace capscrew.
2. Hold alternator close enough to engine to engage fan belt on alternator pulley, then, using pry-bar as shown in Figure 3-2, tighten pivot bolt and adjusting brace capscrew for 3/8" belt deflection with about 10 pounds of applied force.
3. Connect previously removed wiring as labeled.

CAUTION: Be certain that connections are properly made and secured.

F. DISASSEMBLY, REPAIR, REASSEMBLY

Refer to REPAIR MANUAL for proper procedures.

TOPIC 4. STARTER MOTOR

A. DESCRIPTION

The starter motor is designed to operate under overload conditions and to produce high torque. Because of its limited physical size it can only do this for short periods of time, since in order to produce such power a high electrical current must be used. High current creates considerable heat and if the starting operation is continued for any length of time, the accumulated heat will cause serious damage.

> CAUTION: Starter must never be used for more than 30 seconds at any one time. Allow starter motor to cool for 2 minutes before using again. Never use starter to move truck.

The drive mechanism incorporates a locking feature which prevents demeshing of the drive pinion from the flywheel ring gear, until a predetermined flywheel speed is reached. The automatic meshing of the drive pinion with the flywheel ring gear is accomplished in the usual manner. If the engine fails to continue running, due to weak or irregular firing, premature demeshing of the pinion from the ring gear is prevented by the locking feature.

A magnetic solenoid switch is used in the starter motor circuit since it uses less electrical current, and allows use of a starter switch and lighter gauge wiring. The starter solenoid is mounted on the starter housing.

The starter motor is a completely enclosed unit and requires very little maintenance. However, to ensure satisfactory operation, periodic inspections should be made to make sure mounting and wiring connections are tight and in good condition.

B. INSPECTION

1. **Verify that starter motor electrical** connections to battery are clean and tight.

> NOTE: Loose or dirty connections anywhere in the electrical circuit will cause high resistance and reduced cranking efficiency.

2. **When all mounting and wiring connections** are kept in good condition, and the starter motor responds instantly and cranks engine when the ignition switch is closed, the starter motor may be considered to be in satisfactory working condition.

> NOTE: The starter motor is equipped with graphite and oil impregnated bushings which should be lubricated only when motor is disassembled.

C. REMOVAL

1. Lift operator's seat and swing open side panel.
2. Disconnect battery cable leads at battery to guard against possible electric shock during removal.
3. Disconnect and label all electrical connections at starter motor.
4. Remove mounting bolts which secure starter motor to flywheel housing.
5. Carefully pull starter motor assembly out of flywheel housing until drive end clears flywheel housing, then tilt commutator end up to remove unit from truck.

> NOTE: For DISASSEMBLY, INSPECTION, REPAIR and REASSEMBLY, refer to REPAIR MANUAL.

D. INSTALLATION

1. Insert drive end of starter motor in flywheel housing. If drive mechanism is fully extended, then mesh pinion gear with flywheel ring gear.
2. Install mounting bolts and tighten securely.
3. Connect all electrical leads to starter **motor as labeled.**
4. Connect battery positive lead to positive post and negative lead to negative post.
5. Close side panel and lower operator's seat.

TOPIC 5. ELECTRICAL WIRING

A. DESCRIPTION

For the most part, the electrical wiring that interconnects all the electrically operated components of the truck is grouped in a harness assembly which is properly taped and securely clamped to the truck frame. Wherever necessary, wires are protected by loom and rubber grommets to prevent chafing where direct contact is made with the frame or the engine.

Individual wires in the wiring harness are color-coded for ease of identification, since; in the covered harness, only the extreme ends of the individual wires are visible. This color coding facilitates ease of identification during installation, trouble-shooting and repair.

The wiring diagrams (Figs. 1-1 and 1-2) show connections, wire colors and wire gauges.

B. SERVICE (REMOVAL/INSTALLATION)

It is recognized that replacement of one or more individual wires may be necessary and that complete harness replacement may be impractical. Emergency repair can be made by installing a new wire between two points, and disconnecting the old or defective wire at each end.

CAUTION: Because of the potential danger of electrical shock, it is wise to disconnect the battery cables during electrical repair work.

Select the desired length, color and gauge wire for replacement. Run the new wire along the wire harness and attach it in several places with electrical tape. Attach new terminal tips to the replacement wire and after covering terminal wire connection with tape or neoprene tubing, attach both ends of wire to respective component tie point.

NOTE: Always keep connections clean and tight to ensure low resistance conductivity.

Check for defective circuits is easily accomplished. Disconnect wires at both ends of suspected circuit. With a test lamp, touch test probes to each end of circuit and if test lamp fails to light, circuit will have to be repaired or replaced.

TOPIC 6. HORN AND HORN RELAY

A. DESCRIPTION

The horn is a magnetically sensitive, vibrating unit, and is actuated by a horn relay which, in turn, is energized by the horn button located in the center of the steering wheel. The horn and horn relay are located on the right hand cowl support.

The horn is relay operated to provide shorter, more direct electrical connections between the battery and the horn. This supplies a higher working voltage at the horn with a resultant improved performance and avoids the necessity of pulling the full current load through the horn button.

When the horn button is depressed, current flows through the relay coil, with a resulting magnetic field induced in the relay coil and core, which attracts the relay armature. The armature is pulled downward against a spring tension and closes the battery to horn circuit contact points.

B. SERVICE

Before checking horn and horn relay, make certain battery is connected and that it is producing the rated voltage output. If the battery circuit is operating properly, proceed as follows:

1. If horn produces a weak signal, connect a voltmeter from ground (truck chassis) to horn terminal, press horn button and note voltage reading on voltmeter. If voltage is between 0 and 10.7 volts, check for an open circuit, defective horn relay, poor wiring or a shorted horn coil.

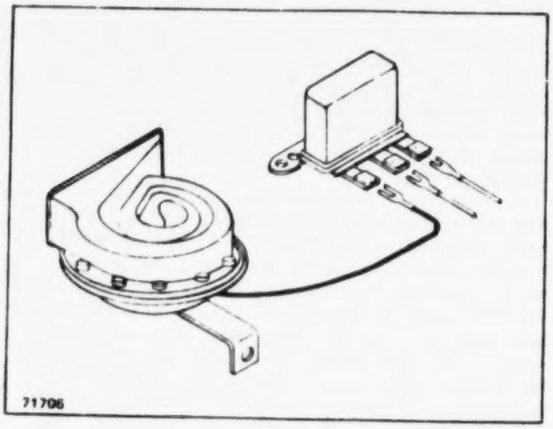


Figure 6-1. Horn and Horn Relay

2. If horn signal is weak and voltage at horn terminal is normal, check volume adjusting screw in horn cover. Screw turns IN or OUT to increase or decrease volume.

3. If horn relay requires adjustment, cover can be removed and relay points correctly gapped. (Refer to HORN RELAY ADJUSTMENT in REPAIR MANUAL for proper procedure.) Air gap setting at coil is 0.020" with points closed, and 0.018" with points opened. The correct closing voltage is 8.3 to 10.2 volts.

TOPIC 7. IGNITION COIL

A. DESCRIPTION

The purpose of the high voltage ignition coil is to deliver high voltage surges to the spark plugs, via the distributor. The ignition coil accomplishes this by stepping up a primary input voltage of 12 V.D.C. to a surge of about 20,000 V.D.C. through normal transformer action.

The coil consists of a primary and a secondary winding. (See Figure 7-1) The primary winding contains about 200 turns of heavy wire, and the secondary winding contains about 20,000 turns of very fine wire. To concentrate the magnetic field, these windings surround a soft iron core composition and are enclosed by a soft iron shell. The entire assembly is built into a one piece steel coil case which is oil filled and hermetically sealed by the cap and gaskets. This construction prevents moisture from entering the coil and also permits faster dissipation of the generated heat.

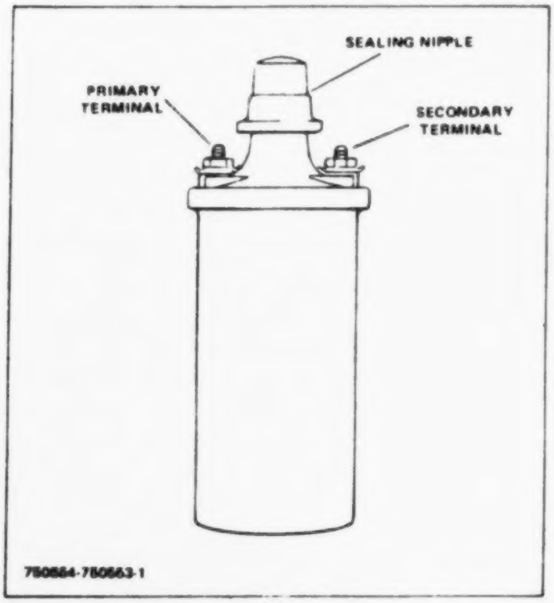


Figure 7-1. Ignition Coil

The coil has two primary terminals marked "+" and "-" on the exterior cap. (The proper polarity is noted on the ignition wiring diagram.) The coil is generally mounted as near as possible to the distributor in order to keep the interconnecting high tension lead as short as possible. (This reduces the possibility of a high voltage arc between the wire and any chassis (ground) points it might otherwise contact.)

All the ignition cabling in the high tension circuit (coil to distributor to spark plugs) is neoprene covered and is resistant to oil, grease, battery acid. This type of insulation also helps to prevent current losses.

B. SERVICE

The ignition coil requires no particular service other than an occasional operational performance check. Also check electrical contact points for cleanliness and tightness of connection. The coil can only be tested on a reliable coil testing machine; however, if the engine is quick starting and smooth running it can be assumed that the ignition coil is performing satisfactorily.

C. REMOVAL

1. Disconnect and label primary lead, resistor lead and condenser lead attached to cap of ignition coil.
2. Pull high tension (secondary) wire out of center of cap.
3. Loosen securing clamp and remove ignition coil.
4. Clean exterior of coil assembly with an acceptable cleaning solvent. Check that primary connectors are free of dirt and grime and provide a good electrical connection.
5. Remove sealing nipple and check for cracks. Replace, if damaged.
6. Inspect high tension terminal for foreign deposits and clean, if necessary.
7. Inspect entire case for cracks or oil seepage. Replace, if damaged.
8. Place ignition coil on ignition coil tester and check for proper voltage output and voltage breakdown. Take action as indicated by test results.

D. INSTALLATION

1. Insert ignition coil in retaining clamp and secure clamp.
2. Insert high tension lead in center of ignition coil cap. Press down firmly and feel definite snap as it seats properly. Ensure that sealing nipple is pressed firmly against coil cap shoulder.

3. Reconnect condenser lead to post from which removed and reconnect primary and resistor lead to primary post from which removed.

NOTE: Ensure that proper "+" or "-" polarity is strictly observed.

4. Ensure that all electrical connections have been properly made, i.e., coil to distributor to spark plugs, etc.

NOTE: The ignition coil center tower rubber "Boot" should always be replaced when a new coil is installed. Carbonized tracks in the rubber "Boot" form when a coil failure is due to a "burned tower", and if the rubber boot is not replaced, early failure of the new coil can be expected.

TOPIC 8. DISTRIBUTOR

A. DESCRIPTION

The distributor delivers the high voltage surge, induced in the ignition coil secondary, to the spark plugs at the proper time for sequential cylinder firing. The distributor is mounted on the cylinder head, and is driven off the oil pump shaft at one-half of the engine crankshaft speed.

The distributor consists of a cast housing into which a shaft and weight base are fitted in a bronze bushing. Centrifugal advance weights are pivoted on studs in the weight base and are free to move against the calibrated weight springs which connect them to the breaker cam assembly.

During the time the contact points remain closed, current flows from the battery, through the ignition coil primary windings, the contact points and back to the battery through a ground return. Energy in the form of magnetism is stored in the ignition coil. As the distributor breaker cam continues to rotate, the next cam lobe is brought around to where it strikes the breaker lever rubbing block and opens the contact points.

The open contact points break the electrical circuit and although current tends to continue to flow through the coil because of self-induction, it is shunted through a capacitor to prevent arcing across the open points. The stored magnetic energy in the coil collapses producing a very high voltage in both windings. The energy in the coil begins to drain through the secondary high tension lead, into the center of the distributor cap, through the rotor and then jumps to the electrode opposite which the rotor has been positioned, out through another high tension lead and finally fires the proper spark plug.

The spark is sustained through several degrees of crankshaft rotation. At the same time, the shunted energy in the condenser discharges back through the primary circuit, but not until the spark is completed at the plug, and the whole firing cycle starts again.

B. REMOVAL

1. Remove the high tension wiring from the spark plugs and the high tension wire from coil to distributor at the coil. Remove the primary lead that runs from side of distributor to coil primary connection. Tag spark plug wires.
2. Remove capscrew, lockwasher, and distributor clamp arm and lift distributor assembly from cylinder head opening.
3. Unlock distributor cap retaining screws and remove cover assembly.

C. INSPECTION

The distributor cap should be removed at regular intervals to examine the contact points, rotor and the cap.

> NOTE: Dust cover under distributor cap must be removed before points can be checked.

1. Check all high tension wiring for defective insulation and poor connections at distributor cap and spark plug connectors.
2. Wipe distributor cap and check cap and rotor for cracks or carbon tracks indicating leakage of high voltage current across surface.
3. Check centrifugal advance mechanism by turning breaker cam in direction of rotation and then releasing it. Advance springs should return cam to its original position without sticking.
4. Remove dust cover and inspect contact points. If points are badly burned or pitted, they must be replaced and adjusted. Replace every 500 hours.

> NOTE: Refer to ENGINE MAINTENANCE MANUAL, TIMING Section for proper procedures.

5. Replace contact points, dust cover and distributor cap.

D. INSTALLATION

1. Remove distributor cap and insert distributor assembly into opening in cylinder head.
2. Using rotor, turn distributor shaft until offset tongue of distributor coupling enters groove in top of oil pump drive gear.
3. Install distributor clamp arm, washer and capscrew and tighten securely. Replace distributor cap and secure.
4. Install high tension wiring to spark plugs, and connect high tension wire from distributor cap to ignition coil. Replace primary lead from distributor to coil, at coil primary connection.

> NOTE: Refer to REPAIR MANUAL for DISASSEMBLY, REPAIR AND REASSEMBLY and refer to ENGINE MAINTENANCE MANUAL for proper TIMING procedure.

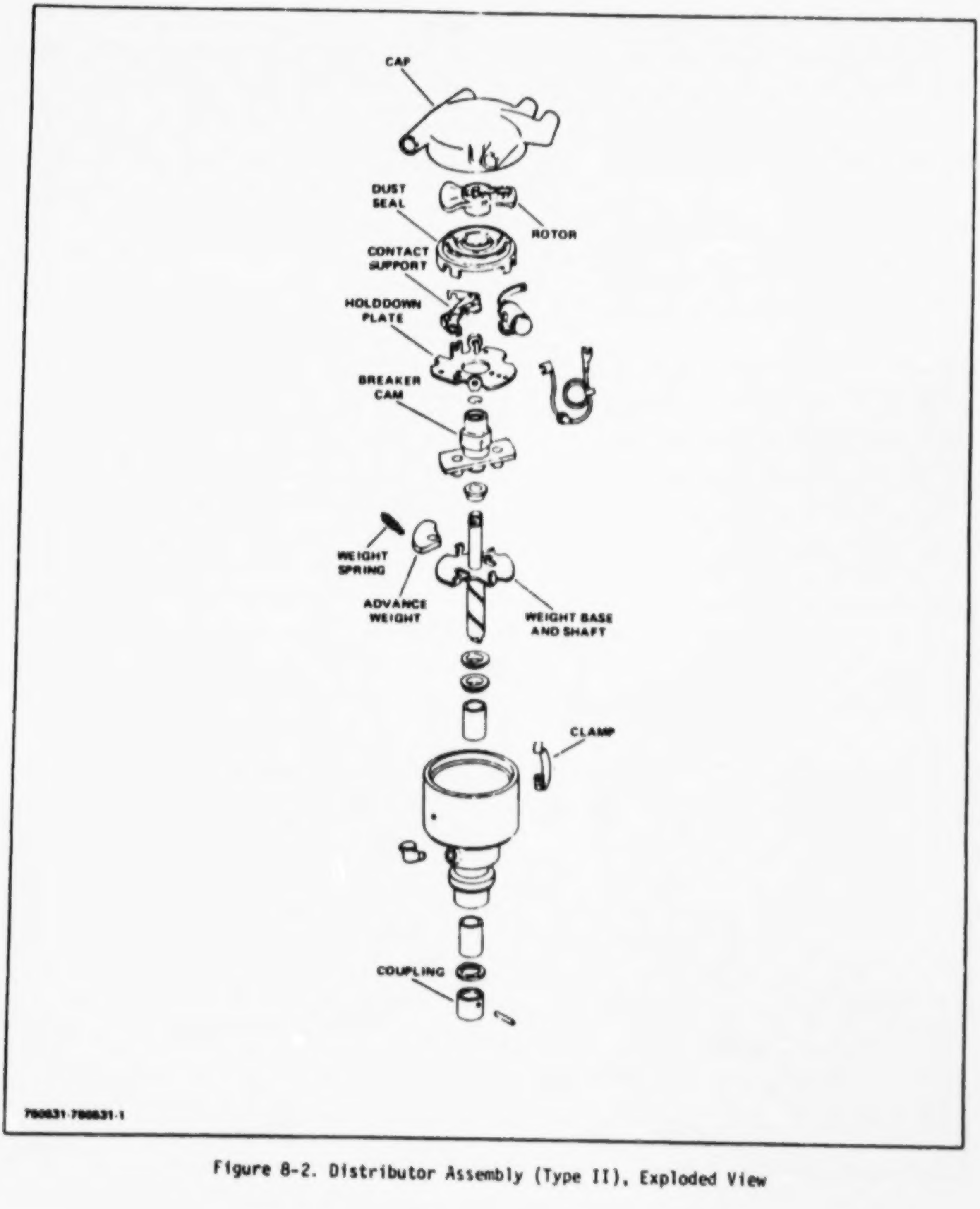

CAP
DUST SEAL
ROTOR
CONTACT SUPPORT
HOLDDOWN PLATE
BREAKER CAM
WEIGHT SPRING
ADVANCE WEIGHT
WEIGHT BASE AND SHAFT
CLAMP
COUPLING
750631-750631-1

Figure 8-2. Distributor Assembly (Type II), Exploded View

MEMO

TOPIC 9. INSTRUMENTS

A. DESCRIPTION

The truck instrumentation consists of the following components: an oil pressure gauge, a coolant temperature gauge, fuel gauge, ammeter and engine hourmeter. All the instruments are mounted on the instrument panel and are display oriented for ease of use. Also mounted on the instrument panel are the ignition switch, the electrical fuses and the manual choke control.

1. Ammeter:

Connected directly into the battery circuit, this gauge indicates the status of the battery and the direction of current flow. Pointer deflection to the "charge" side of dial face indicates that the battery is being charged by the alternator and pointer deflection to the "discharge" side of dial face indicates that the battery is discharging. Normally, the "charge" rate will be high for a short time after starting engine, with pointer returning to slightly above zero after a few moments of operation. However, if battery is run down, the "charge" rate may remain high for some time. If the ammeter indicates a "discharge" condition when engine is operated above idle speed, then the alternator is not producing current, or there is a short in the circuit.

2. Oil Pressure, Coolant Temperature and Fuel Gauges:

The oil pressure, coolant temperature and fuel level gauge all operate similarly in that one side of each gauge is tied to the ignition switch, while the other side is connected to the respective sensing sender unit.

The oil pressure sending unit mounts on the engine oil gallery, the coolant temperature sending unit is located in the cylinder head coolant outlet passage, and the fuel level sending unit is installed in the fuel tank assembly. The rheostat sensor in the sending unit allows more electrical current to flow through the respective gauge deflection coil as the oil pressure increases, the engine coolant becomes warm, or as the fuel tank is being filled.

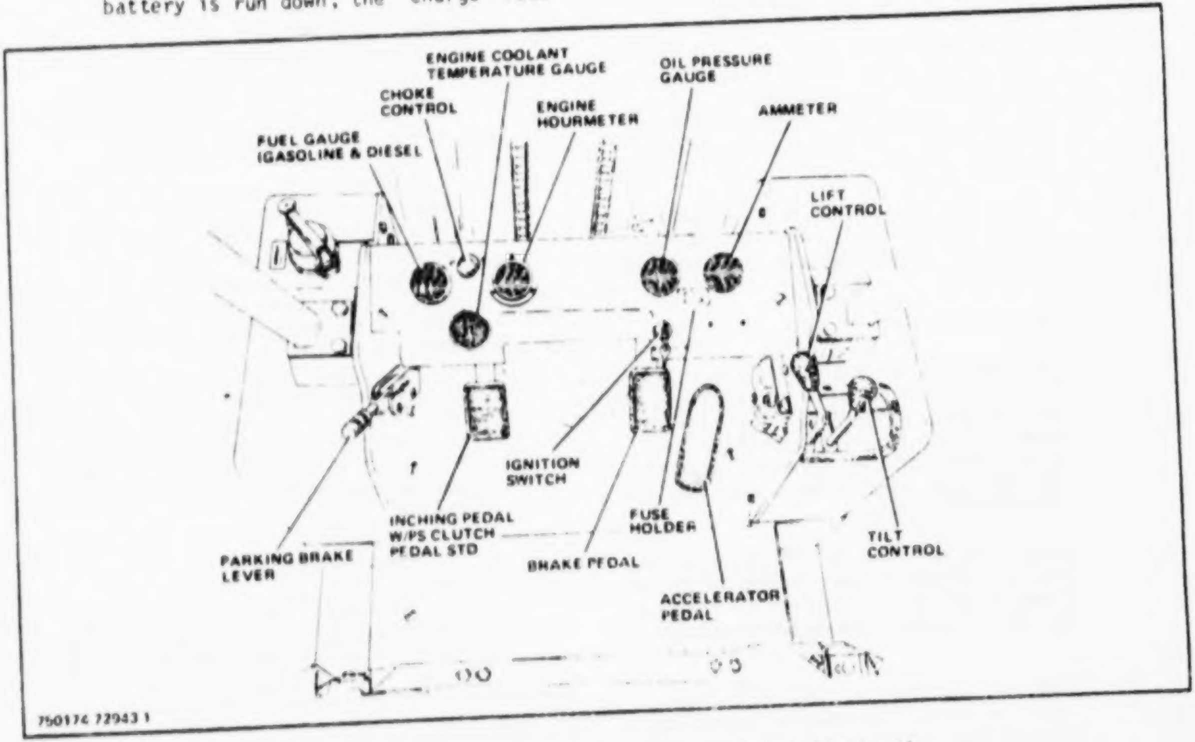

ENGINE COOLANT TEMPERATURE GAUGE
OIL PRESSURE GAUGE
CHOKE CONTROL
ENGINE HOURMETER
AMMETER
FUEL GAUGE (GASOLINE & DIESEL)
LIFT CONTROL
IGNITION SWITCH
INCHING PEDAL W/PS CLUTCH PEDAL STD
FUSE HOLDER
TILT CONTROL
PARKING BRAKE LEVER
BRAKE PEDAL
ACCELERATOR PEDAL
750174 72943 1

Figure 9-1. Instrument Panel (Power Shift) (Typical)

These gauges provide quick response, direct read-out dial indications of engine system conditions during engine operation. If any of the units become inoperative, check the wiring circuit, or determine whether the gauge or the sending unit is defective by replacing with one which is known to be good.

CAUTION: Do not attempt to repair gauges or sending units, but always replace defective item whenever necessary.

3. Engine Hour Meter:

The engine hour meter is a direct reading type. The unit records up to 9999.9 hours and then automatically returns to 0000.0. The four figures are read directly to record hours, while the figure on the right records 10ths. of an hour.

The engine hour meter starts recording when the ignition switch is turned on. Meter will stop recording when the ignition switch is turned off.

If the hour meter does not operate or runs erratically, check wiring for poor terminal connections, a loose joining connection, bare or frayed wires. Repair or replace as is required.

Since the hour meter is a completely sealed unit, it will have to be replaced if tests indicate the meter is defective.

4. Ignition Switch:

The ignition switch closes the electrical circuit between the ignition coil primary winding and the battery. Accordingly, it has one battery terminal lead, and one terminal lead to the ignition coil primary post and the instrument gauges.

Since the ignition switch operates the starter solenoid when turned to the extreme right, a third terminal is used to run a lead to the starter solenoid.

When the ignition switch is in the "OFF" position, current is turned off between the ignition switch, the ignition coil and the instrument gauges. With the switch turned to the "ON" position, current can flow between the battery, the ignition coil and the gauges.

Turning the switch to the "START" position, (which has a spring-loaded return), causes current to flow to the starter solenoid switch to actuate the starter motor. As soon as the engine starts and the ignition key is released it will automatically return to the "ON" position. The engine will continue to run in this position until the ignition switch is turned to the "OFF" position.

The current type ignition switch has a built in interlock. Whenever the switch is in "ON" position, it must be returned to "OFF" position before it can be turned to "START" position.

The various ignition switch circuits can be checked by removing wires from their respective terminals and holding test lamp probes to each terminal. If lamp fails to light, wire is defective and should be repaired or replaced.

WARNING: This could be dangerous work. Electrically - it is always wisest to disconnect the battery when any trouble-shooting or maintenance is performed on the electrical system.

5. Fuses:

Fuse protection is wired into the horn and instrument gauge circuits to prevent burning up of this unit in case an electrical short circuit developes. The gauges are protected by a 10 ampere fuse and the horn and horn relay circuit is protected by a 10 ampere fuse. Both fuses are located in clip retainers on a fuse block on the right underside of the instrument panel. If either the gauges or the horn fail to operate, then the fusing should be checked first. If a fuse is blown, it should be replaced with a fuse of identical rating.

6. Instrument Panel:

The instrument panel can be removed from truck and reinstalled by following the typical procedure as outlined below.

NOTE: For safety purposes, the battery should be disconnected to prevent the possibility of electrical shock.

a. Removal

(1) Remove hardware, choke cable, and harness clamps, then lift up: panel cannot be completely removed from truck.

(2) The removal of any damaged or defective component is apparent. Most components are retained by locknuts and washers. Removal of any damaged or defective components can be accomplished by removing the retaining hardware. When installing, always make certain unit is securely mounted and that all connections are tight.

NOTE: Due to styling and model changes, subtle differences may exist in the instrument panel mounting hardware. Removal and installation procedures will generally follow these instructions and any variations will be obvious.

b. Installation

(1) Ensure that all attaching components are properly mounted, secure and that associated wiring is properly connected.

(2) Ensure that side panel anchor supports and lock pins are all properly aligned and that instrument panel is securely retained.

(3) On ACC model trucks connect fuel gauge sender lead at connector behind left side of instrument panel.

(4) Reconnect battery cables and make sure posts and cable terminals are secure and corrosion free. Make certain that positive battery cable is attached to positive post and that negative cable goes to the negative post.

MEMO

TOPIC 1. COOLING SYSTEM

A. DESCRIPTION

The cooling system consists of the following component parts: the radiator, water pump and thermostat, the cooling fan and fan belt, the water passages in the cylinder block and head, and the necessary hoses and lines to complete the system.

The purpose of the cooling system is to carry off the excess heat from the engine, and to hold the engine at an efficient operating temperature. This is performed in the following manner:

The centrifugal water pump, which is driven by a "V" belt from the fan drive pulley, pulls the coolant from the bottom of the radiator and circulates it through the water passages in the engine block and cylinder head. The coolant then passes from the cylinder head of the engine through the thermostat and the upper radiator hose to the upper part of the radiator. The coolant then passes from the top to the bottom of the radiator and is cooled by the air flow pushed through the radiator core by the cooling fan.

If the temperature of the coolant is less than 180°F, the thermostat remains closed and the coolant is bypassed back to the pump and is recirculated through the engine without passing through the radiator. When the coolant temperature exceeds 180°F, then the thermostat begins to open and permits the coolant to flow into the radiator where it is cooled by the belt-driven cooling fan. At approximately 200°F, the thermostat will be completely open and the coolant will flow at the maximum rate through the radiator until the average temperature has been reduced and the thermostat closes.

B. GENERAL MAINTENANCE

Proper cooling system maintenance requires the observance of the following procedures:

1. Coolant: Keep sufficient cooling liquid in the system, but do not overfill. A basic coolant is fresh, clean, soft water to which is added a 2% solution of rust preventive soluble oil. At temperatures below 32°F, the cooling system should be protected from freezing by adding a sufficient quantity of a permanent type (glycol base) anti-freeze solution.

2. Cleaning: Drain, flush and refill the system whenever an inspection reveals an accumulation of rust or scale deposits. Always clean the cooling system seasonally, as well as before and after using anti-freeze solutions.

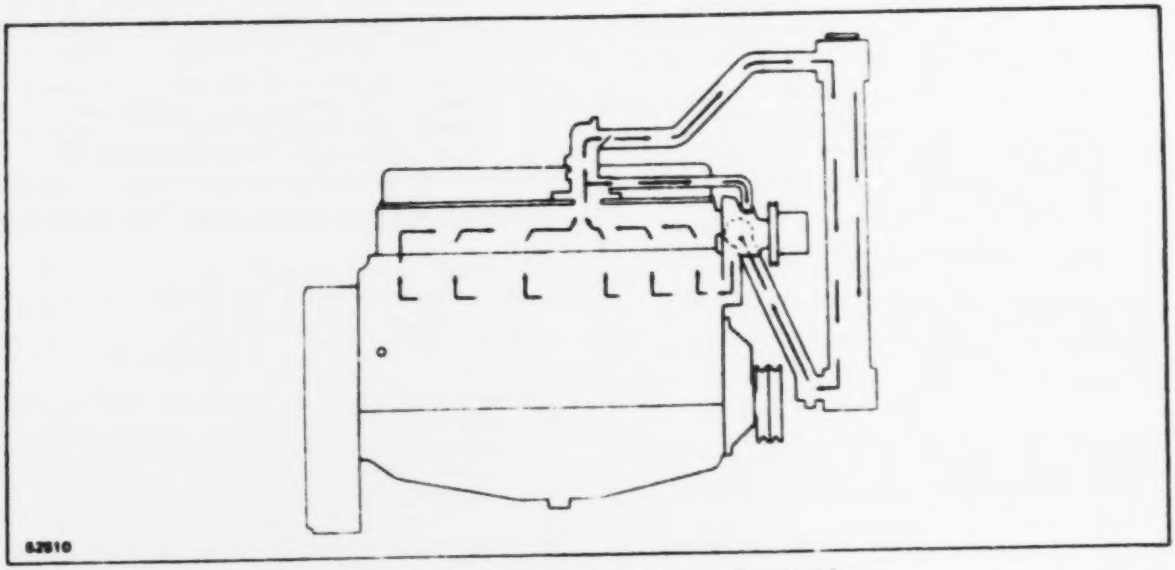


Figure 1-1. Coolant Flow Diagram (Typical)

3. Overheating: If the engine overheats from lack of coolant, do not add fresh coolant immediately. Wait until the boiling has ceased and the engine has cooled down. Then add coolant slowly, with the engine running. If a cold coolant is poured into the system when the engine is hot, the sudden temperature change may damage the radiator, cylinder block or cylinder head.

4. Protection: Keep cylinder head capscrews, water pump capscrews, hose clamps and all fitting connections tight. All leaks must be corrected as soon as they are evident. Inspect hoses carefully and replace if they are deteriorated.

5. Fan Belt: It is very important to occasionally inspect the fan belt, making certain that no oil or grease is accumulating on it and that the fan belt tension is kept in correct adjustment. Replace a badly worn, burned, oil or grease soaked belt. Be sure correct type of belt is used.

6. Thermostat: Maintaining the correct engine temperature depends mainly on the proper function of the thermostat. If the engine temperature remains consistently below normal, the thermostat should be removed and inspected. If corroded or stuck, a new thermostat must be installed.

CAUTION: Do not operate engine without thermostat installed! On Teledyne Continental engines the thermostat forms an important function in achieving proper coolant flow through the radiator. The engine should never be operated without a thermostat installed, as severe overheating and serious engine damage can result.

C. SERVICE

1. Summer: In warm weather keep the cooling system filled with clean, soft water or rain water. If permanent anti-freeze is not available and hard water is used, the hard water should first be treated with a water softener. Eight ounces of a reliable commercial rust inhibitor (soluble oil) should be added to the coolant during warm weather operation.

2. Winter: In winter weather use a non-evaporating ethylene glycol base anti-freeze solution in the cooling system to protect against damage from freezing.

   After the cooling system has been thoroughly cleaned and inspected, determine the quantity of anti-freeze required for the lowest anticipated temperature by referring to the protection chart furnished by the manufacturer. Add this quantity to the radiator. Then fill complete cooling system; but do not overfill. Run the engine to thoroughly mix the water and the anti-freeze, and to allow the coolant to reach operating temperature. Finally, test the coolant with an ethylene glycol hydrometer to make sure it will withstand the prevailing or anticipated temperature. See chart below for correct solution.

CAUTION: Never mix anti-freeze compounds or inhibitors with any cleaning neutralizing, or flushing compounds.

Temperature Range	Parts Glycol	to	Parts Water
32° to 10°F	1		4
+10° to -10°F	2		5
-10° to -30°F	1		1

TOPIC 2 RADIATOR

A. DESCRIPTION

The radiator (Figure 2-1) is of the fin and tube type and is vertically supported by angle bracing to the truck frame. The front of the radiator is protected from structural damage by a heavy grille mounted in the counterweight. An overflow tube is connected to the filler neck and leads to the bottom of the radiator.

B. REMOVAL

When it becomes necessary to remove the radiator for service, the following procedure is recommended:

1. Remove the side panels and raise the operator's seat.
2. Remove the radiator cap, open the drain cocks located underneath the alternator (Figure 2-2) and in radiator outlet elbow to drain the cooling system.

CAUTION: When removing the filler cap, rotate the cap counterclockwise very slowly; if hissing of vapor is encountered, tighten cap immediately and wait for system to cool sufficiently to allow removal of cap.

CAUTION. Never pour cold-water or cold anti-freeze into the radiator of an OVERHEATED ENGINE. Allow the engine to cool and avoid the danger of cracking the cylinder head or block. Keep engine running while adding water.

3. Loosen the retaining hose clamps and remove the inlet and outlet hoses from the top and bottom of the radiator.

NOTE: An oil cooler is an integral part of the bottom of the radiator to prevent overheating of the transmission. The oil cooler lines must be removed prior to removing the radiator.

4. Remove securing capscrews and the radiator grille from the back of the frame. Also remove rear section of exhaust pipe and muffler (ACP only).

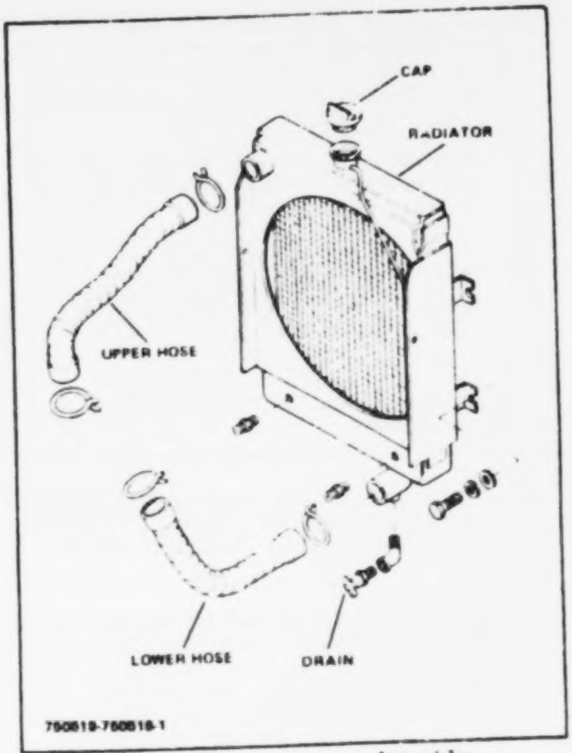


Figure 2-1. Radiator Assembly

5. Remove the capscrews which hold the radiator in position on the mounting bars located on the frame inside the counterweight.

NOTE: A quantity of spacers may have been used between the radiator and the mounting bars. These spacers must be replaced exactly as removed.

6. Slide the bottom of the radiator out of position. After the filler neck of the radiator has cleared the inside top of the counterweight, the radiator can easily be removed.

NOTE: Refer to REPAIR MANUAL for proper RADIATOR INSPECTION, TESTING and REPAIR.

C. INSTALLATION

1. Slide radiator up into mounting position within the counterweight, ensuring against any damage to filler neck or cooling fins.

2. If spacers were present between radiator mounting flange and frame, be sure to replace in their original locations. Use spacers as necessary to prevent fan from hitting radiator.

3. With radiator properly aligned, install two capscrews through radiator mount to frame support bars.

4. Install grille and secure grille and radiator with two capscrews. Secure grille with two remaining capscrews. Install muffler and tail pipe section (ACP only).

NOTE: The oil cooler lines will have to be reinstalled.

5. Install upper and lower radiator hoses and secure retaining clamps. If hoses are cracked or cut, they must be replaced.

6. After radiator is installed, measure distance between the leading edge of the fan blades and the radiator core. This dimension should be at least 7/8". Also ensure that the cooling fan is properly centered within the radiator shroud.

7. Close the cooling system drain cock located below the alternator and at bottom of radiator (Figures 2-1 and 2-2). Fill system to recommended capacity with coolant; replace pressure cap and check for any leaks.

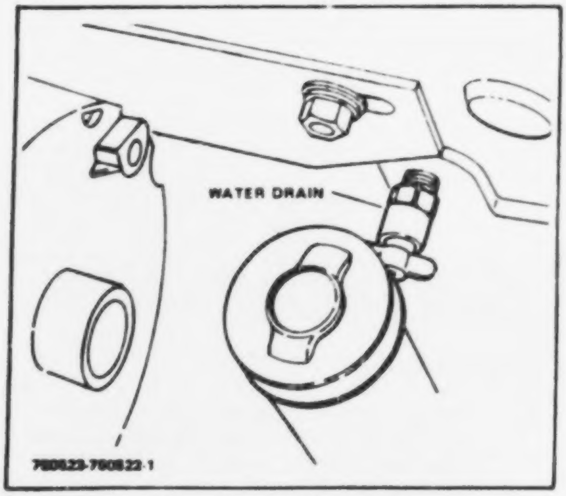


Figure 2-2. Water Drain

NOTE: Allow engine to reach normal operating temperature. The thermostat will then open and the coolant will flow into the engine. Coolant level must then be "topped-up."

8. Replace the side panels, and lower operator's seat.

D. RADIATOR PRESSURE CAP

A seven-pound pressure cap (Figure 2-3) is installed on the radiator filler neck. As long as there is pressure in the cooling system, the temperature can be considerably higher (over 220°F) than the boiling point of the solution in the radiator at atmospheric pressure without causing the solution to boil. Removal of the radiator cap while the engine is hot and the pressure is high will cause the solution to boil intantaneously and possibly with explosive force, spewing the coolant over the engine and the person removing the cap. There is also the possibilty of causing serious burns.

Pressure caps should be checked at least once a year and care should always be taken in filling radiators that no damage is done to the pressure cap seat in the radiator filler neck.

CAUTION: When removing the filler cap, rotate cap counterclockwise very slowly; if hissing of vapor is encountered, tighten cap immediately and wait for system to cool sufficiently to allow removal of cap.

After pressure in the system has been relieved, turn cap counterclockwise and remove.

Turn cap clockwise when installing. Cap must form a tight seal to prevent any leakage.

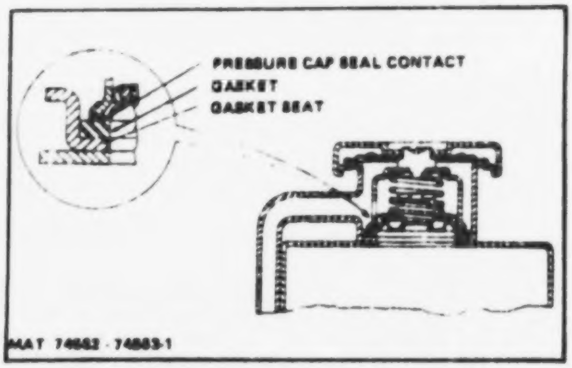


Figure 2-3. Pressure Cap, Section View

TOPIC 3. WATER PUMP

A. DESCRIPTION

Liquid coolant is circulated through the engine and the radiator by a centrifugal water pump. The pump is enclosed in a sealed, cast metal housing and is flange mounted to the front of the cylinder block. The pump impeller is pressed on one end of the pump steel shaft and the fan mounting hub is pressed on the other end. The shaft is supported at the drive end by a sealed, double row ball bearing, and is prevented from moving endwise by a shoulder in the pump housing and a snap ring on the outside.

The construction of the water pump is conducive to long life with minimum attention if clean coolant is used in the system. Water containing scale forming elements is especially harmful to the pump parts due to corrosion.

The water pump requires no attention other than bearing replacement when bearings show excessive looseness, or if a water leak develops, which shows a damaged or badly worn seal that needs replacement.

B. REMOVAL

When it becomes necessary to remove the water pump for service or replacement, the following removal procedure is recommended (Figure 3-1):

1. Open water drain (Figure 2-2).
2. Disconnect by-pass hose and pump inlet hose.
3. Remove fan by taking out four capscrews.
4. Loosen generator so that fan belt can be slacked off enough to slide over pulley.
5. Remove nuts and lockwashers holding the pump body to the front of the block and remove the pump assembly.

NOTE: Refer to REPAIR MANUAL for WATER PUMP DISASSEMBLY INSPECTION, REPAIR and REASSEMBLY.

C. INSTALLATION

1. Clean the gasket mounting surfaces on water pump flange and on cylinder block and install new gasket. Use approved sealing compound as required.

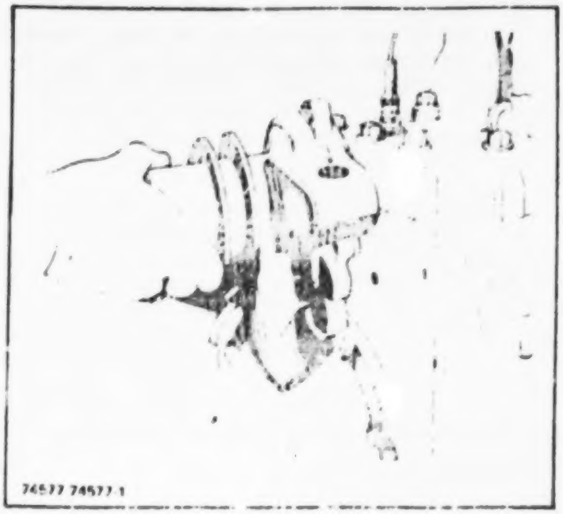


Figure 3-1. Removing Water Pump

2. Mount and secure the water pump with mounting capscrews.
3. Replace the coolant bypass hose and tighten the clamps.

CAUTION: Do not overtighten clamps as this could cause bypass hose to fracture or split.

4. Replace the coolant inlet line at the water pump, and secure with clamp.
5. Install the fan pulley, the fan blade and the mounting capscrews. Tighten capscrews securely.
6. Properly align fan belt at fan drive pulley, fan pulley and alternator pulley.
7. Force the alternator away from the engine with a long handled screwdriver or pry bar until the fan belt has approximately 1/2" to 3/4" deflection at a point halfway between the fan pulley and the alternator pulley, with about 10 lbs. applied force. (Refer to Fan Belt Adjustment.) After proper adjustment, secure alternator capscrews.
8. Close water drains.
9. Fill the cooling system to the recommended capacity with proper coolant and replace radiator pressure cap.

10. Operate the engine until the normal operating temperature has been reached, then check the cooling system for any evidence of leaks. Correct if necessary, and top-up coolant level.

11. Replace the engine side panels and lower the operator's seat.

TOPIC 4. THERMOSTAT

A. DESCRIPTION

The thermostat is installed in the cooling system to regulate the temperature of the coolant, and is located in the water outlet elbow. Normally, when the coolant temperature is 180°F or less, the thermostat is closed, preventing the coolant from flowing through the radiator. When the coolant temperature rises above 180°F, the thermostat begins to open, allowing the coolant to flow through the radiator where the temperature is reduced through the cooling effect of the fan. The thermostat should be fully open at 202°F; in this manner, it acts as a temperature controlled valve that regulates the coolant temperature within its characteristic limits.

The thermostat seldom needs replacement in service, however, it should be checked when the cooling system is cleaned. While removing the thermostat, check the hose; if it shows signs of deterioration when flexed, replace the hose. Also check the hose connected to the bottom of the radiator, and if it shows signs of deterioration, replace it.

CAUTION: DO NOT RUN ENGINE WITHOUT A THERMOSTAT!

B. REMOVAL

1. Replace the thermostat if it sticks in an open or closed position. If the engine overheats or does not reach and maintain normal operating temperature, the thermostat should be removed, tested for proper operation, and replaced if found defective.

2. Remove the engine side panels and raise the operator's seat.

3. Partially drain the cooling system, then remove the clamps from the top radiator hose and the coolant by-pass hose or L.P.G. converter tube. Pull these hoses off the water outlet elbow.

4. Remove two nuts and lockwashers, and lift the outlet elbow off the cylinder head. Remove adapter ring and thermostat from elbow.

5. Before testing thermostat, clean the bellows and examine for rupture or distortion. If the valve can be pulled or pushed off its seat with only a slight effort when cold, or if valve does not seat properly, the unit is defective and must be replaced.

6. Suspend and completely immerse the thermostat in a container of clean water (Figure 4-1). Heat the water and stir with an accurate thermometer to check the water temperature.

7. As the water temperature reaches 180°F, observe the thermostat. If the valve does not start to open at temperatures of 180°-200°F, or if it opens well before the 180° point is reached the thermostat should be replaced.

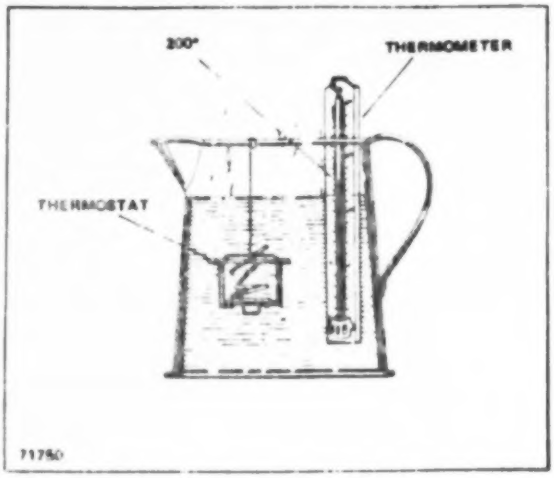


Figure 4-1. Testing Thermostat

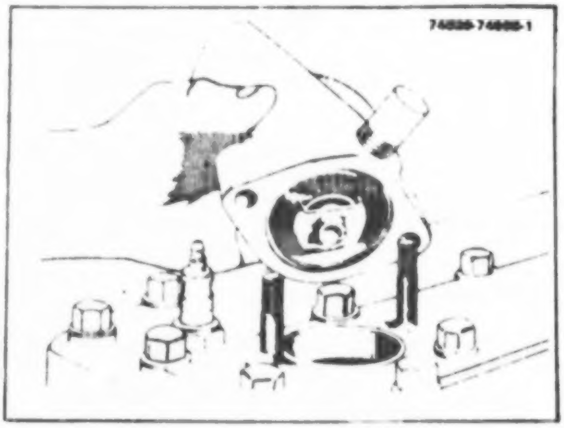


Figure 4-2. Replacing Thermostat

C. INSTALLATION

1. Clean all surfaces of the bypass line, and the thermostat.
2. Inspect upper and lower radiator hoses for any signs of deterioration. Replace if damaged.
3. Use non-hardening gasket sealer and thoroughly cover all rubber hose connections.
4. Properly position thermostat in water outlet elbow and install adapter ring.
5. Assemble new gasket to cylinder head, position water outlet elbow on studs, and secure with two nuts and lockwashers (Figure 4-2).
6. Install outlet hose and by-pass hose or L.P.G. converter hose on outlet elbow and secure clamps.

CAUTION: Thermostat must be installed exactly as it was removed so that the direction and heat of the coolant will open it.

NOTE: When filling the cooling system, care should be taken to keep the coolant clean to prevent any clogging of the cooling system or damage of the water pump. Use only permanent anti-freeze in connection with the 180°F. thermostats.

TOPIC 5. FAN AND FAN BELT

A. DESCRIPTION

The cooling fan (Figure 5-1) pushes air through the engine radiator and helps to cool the engine water as it circulates from the top to the bottom of the radiator core.

B. SERVICE

1. Fan blades seldom require service; however, bent blades will affect the balance of the fan and this is detrimental to the water pump bearing. A fan which is bent will not cool as efficiently as it was originally designed to perform. In the event of damage, the fan should be removed and the blades restored to their original contour or replaced by a new fan assembly.

2. Periodic replacement of the fan belt is a good safeguard against a damaged radiator and unnecessary shutdowns.

NOTE: Attempting to force the fan belt over the pulley while it is under tension is almost certain to cause damage to the pulley or bearings.

C. REMOVAL

Fan Blade:

1. Remove the radiator.
2. Loosen the alternator adjusting bracket capscrew and the alternator mounting capscrews and relieve the fan belt tension.
3. Remove the capscrews and lockwashers which mount the fan on the fan pulley.
4. Repair or replace the cooling fan as required.

Fan Belt:

1. Loosen the alternator adjusting bracket capscrew and alternator mounting capscrews and relieve the fan belt tension
2. Slide the fan belt from alternator pulley and fan drive pulley. Remove fan belt from the fan pulley by sliding it off over fan assembly. Be careful not to damage radiator when sliding the belt past the fan blades.

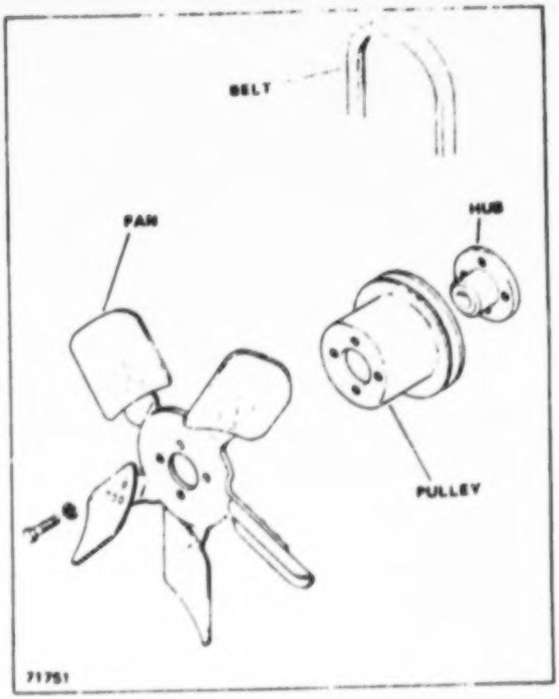


Figure 5-1. Fan Blade, Belt and Pulley (Typical)

D. INSTALLATION

Fan Blade:

1. Replace the fan blade and lockwashers and tighten with mounting capscrews.
2. Install fan belt and ensure that it is properly installed across all pulleys, including fan pulley prior to final tightening of fan blade capscrews.
3. Force the alternator away from the engine with a long-handled screwdriver or pry bar, until the fan belt has approximately 1/2" to 3/4" deflection at a point half way between the fan pulley and the alternator pulley with about 10 lbs. applied force (Figure 5-2).
4. Tighten the alternator mounting capscrews and the alternator adjusting bracket capscrew.
5. Replace radiator. (Refer to RADIATOR INSTALLATION Section.)

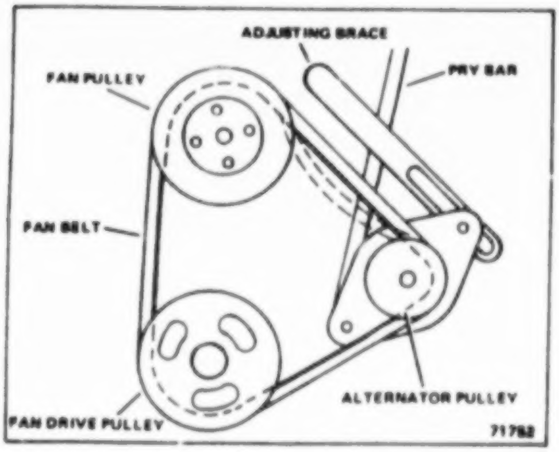

ADJUSTING BRACE
FAN PULLEY
PRY BAR
FAN BELT
ALTERNATOR PULLEY
FAN DRIVE PULLEY
71782

Figure 5-2. Fan Belt Adjustment

Fan Belt:

1. Place replacement fan belt over fan blade and onto fan pulley; then pull belt around fan drive pulley and over alternator pulley.
2. Force the alternator away from the engine with a long-handled screwdriver or pry bar, until the fan belt has approximately 1/2" to 3/4" deflection at a point half way between the fan pulley and the alternator pulley with about 10 lbs. applied force (Figure 5-2).
3. Tighten the alternator mounting capscrews and the alternator adjusting bracket capscrew.

TOPIC 1. TRANSMISSION

A. DESCRIPTION

The "Power-Shift" transmission consists of three major components: The torque converter, a hydraulically actuated clutch pack and a single speed, constant mesh transmission. A single lever type shift control is mounted on the steering column to control the direction of travel through a control valve mounted on the transmission housing.

Power from the engine is delivered to the torque converter which, in turn, drives a pump and clutch pack. Housed in the clutch drum are two double faced clutch plates which, when activated, move the truck forward or reverse through splined hubs, transmitting power to the gear train.

If the reverse clutch is activated, power is delivered to the transmission through a hollow shaft which connects the reverse gear and reverse clutch. If the forward clutch is actuated, power is delivered to the transmission through a solid shaft, which rotates inside the hollow reverse shaft, connecting the forward gear and forward clutch.

TORQUE CONVERTER

The torque converter is composed of three members: The impeller or driving member, the turbine or driven member, and the stator or reaction member. The impeller forms the outer shell of the converter, and the turbine and stator operate within the impeller but turn free of the impeller. The impeller is mounted on the engine flywheel and always turns at engine speed.

The torque converter is filled with oil and when the impeller is rotated by the engine, the oil in the impeller vanes also rotates; and, being subjected to centrifugal force, causes the oil to flow outward. At the beginning, the turbine is stationary, and there is no centrifugal force on the oil in it. Therefore, the oil in the impeller, due to its centrifugal force, enters the turbine near its outer circumference and forces oil from the turbine back into the impeller near its inner circumference. A circulation of oil is set up, which continues as long as there is a difference between the speeds of the impeller and the turbine.

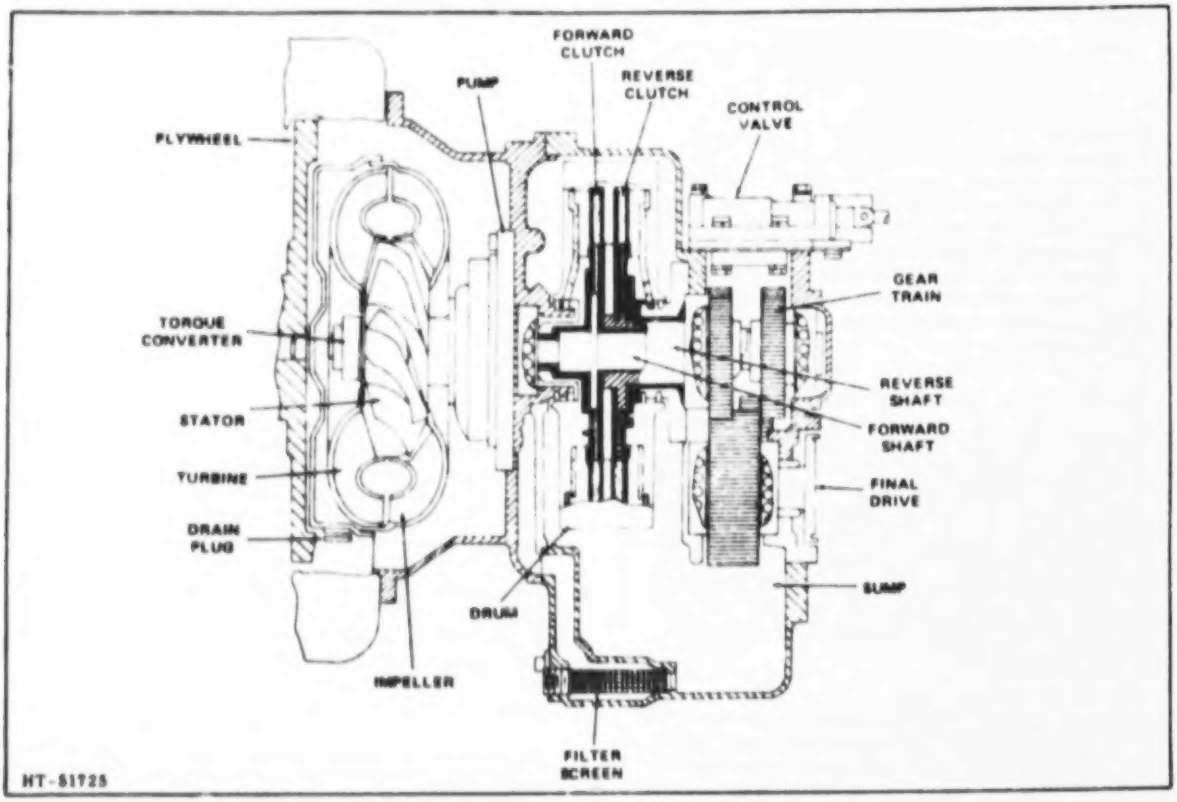


Figure 1-1. Power Shift Torque Converter Drive

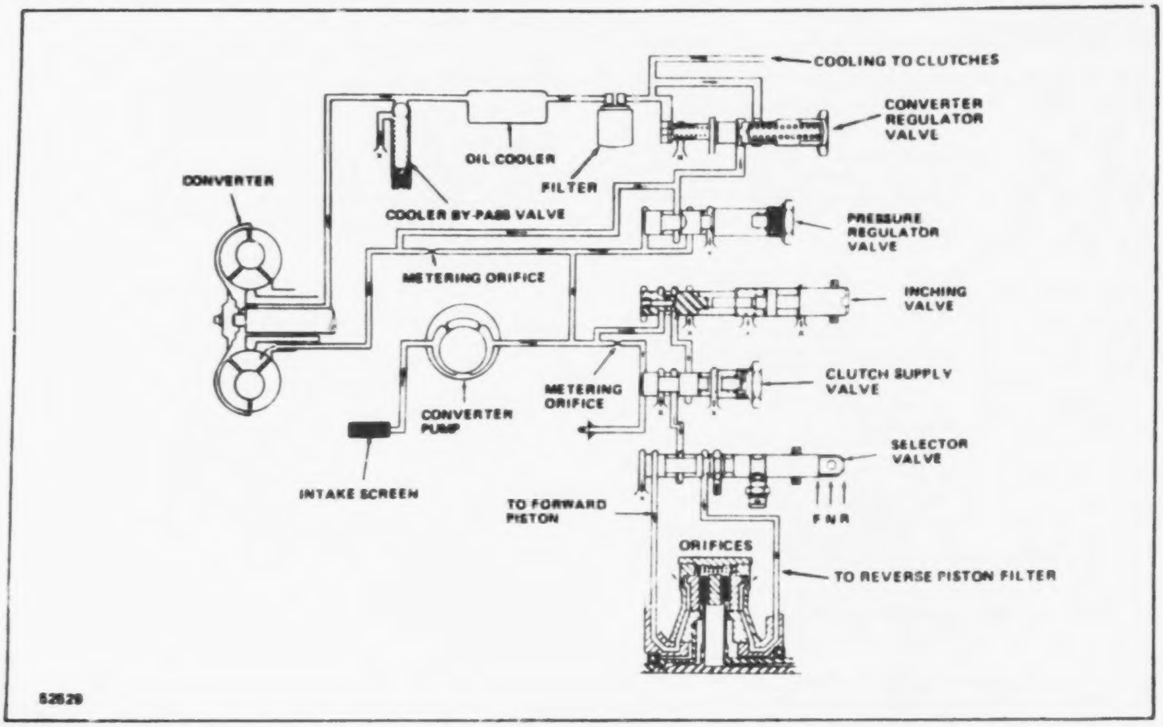

COOLING TO CLUTCHES
CONVERTER REGULATOR VALVE
CONVERTER
OIL COOLER
FILTER
COOLER BY-PASS VALVE
PRESSURE REGULATOR VALVE
METERING ORIFICE
INCHING VALVE
CLUTCH SUPPLY VALVE
METERING ORIFICE
CONVERTER PUMP
SELECTOR VALVE
INTAKE SCREEN
TO FORWARD PISTON
F N R
ORIFICES
TO REVERSE PISTON FILTER
52529

Figure 1-2. Power Shift - Hydraulic Schematic

In normal Lift Truck operation the turbine turns at a slower speed than the impeller an since both are the same dimension, the centrifugal force on the oil in the impeler is always greater than that of the oil in the turbine. It is this difference plus the pressurized oil from the pump which causes the oil to circulate in and through the converter.

From the above it can be seen that the oil in the converter has a dual motion. It travels with the impeller and the turbine around the outer circumference of the converter and it also flows around the inner circumference or central core of the converter. As a result of these motions the oil carries a certain amount of kinetic energy. The velocity of the oil in the converter increases as the oil passes through the impeller to the turbine and decreases as it passes through the turbine back to the impeller.

Since the velocity increases in the impeller, its kinetic energy increases and this gain in kinetic energy can come only from the impeller. That is to say, when increasing the velocity of oil in its vanes, the impeller encounters a resistance, and it takes power (from the engine) to keep the impeller running against this resistance. In the turbine the oil is slowed down and presses forward against the vanes, and when the turbine is moving under this force, power to drive the truck is produced. Thus, all the oil passing through the impeller picks up energy and gives it to the turbine Up to this point operation is the same as a fluid coupling and there is no torque multiplication.

To transmit velocity to the oil at the inner circumference of the converter, a third member, the stator, is added to the fluid coupling, between the impeller and the turbine. It is here that the fluid coupling becomes a torque converter. With the impeller rotating and the turbine stalled, the oil is driven through the curved blades of the turbine. The curved blades redirect the oil in the opposite direction from which it was received. As the oil leaves the turbine blades, it strikes the stator blades causing a reaction which produces torque multiplication.

The stator directs the oil back to the impeller where any remaining kinetic energy combines with the kinetic energy of the impeller oil, producing additional torque multiplication. When the output torque becomes high enough, the turbine starts to turn and the truck will move. As the turbine speeds up and its speed approaches the impeller speed, there is no longer any reaction on the stator and it starts to turn with the turbine. At this point the unit becomes a fluid coupling since there is no longer any torque multiplication.

POWER SHIFT HYDRAULIC SYSTEM:

The transmission hydraulic system consists of the torque converter, a hydraulic pump, the control valve and the clutch pack.

Control Valve

The control valve is mounted on the transmission housing and forms the top closure of the gear case. Machined porting plates are attached to the bottom of the valve to eliminate external piping. Passages in the plates align with passages drilled or cast into the transmission housing.

Clutch Pack

The clutch pack consists of a drum, a forward and a reverse clutch, and pistons and cylinders. The clutches are engaged by oil pressure applied behind the clutch pistons, which causes engagement within the drum.

Oil Pump

The gear type oil pump provides hydraulic pressure for the converter and the clutch pack. It is directly driven from the input side of the converter. Since the converter is mounted on the flywheel, the pump is in operation whenever the engine is running. This means that there is hydraulic pressure even with the engine idling.

Hydraulic oil enters the pump through the intake screen and case passages. Oil leaving the pump is directed through case and adapter passages to all open valve body passages and through an orifice to convertor. The orifice acts to drop pressure of the oil entering the converter. Oil leaving the converter is fed through cooler and cooler bypass valve. The bypass valve remains closed unless the pressure exceeds the valve opening limits. Oil returning from the cooler is directed to clutch cooling and lube circuit.

Pressure Regulator Valve

Oil from the pump, after filling all open circuits, begins increasing in pressure and continues to increase until the force from the oil on the end of the pressure regulator valve overcomes the spring force and moves the regulator valve to a position where main line oil is fed to converter circuit. Feeding mainline oil into the converter circuit lowers line pressure and permits the spring force to balance the force from the oil on the end of the regulator valve, thus regulating line pressure. Oil from the regulator valve is fed through an external tube to bypass converter feed orifice to provide greater oil flow through converter and cooler circuit.

Inching Valve

The inching valve, when the inching valve plunger is in, will regulate the clutch maxmum pressure, determined by the spring or springs used in this location. Depressing the inching pedal permits the plunger to move away from the spring, decreasing spring's effect on the inching valve to lower clutch pressure. Clutch pressure can be varied from 0 to maximum pressure obtainable from the spring combination in the valve body assembly. Clutch pressure regulated by the inching valve is less than the pressure regulated by the regulator valve. Pressure recommendations for your particular model should be obtained from the equipment manfacturer.

Clutch Supply Valve

Line pressure on the end of clutch supply valve moves valve against spring force and permits oil to feed from the inching valve to manual valve. The high and low gear cam operated valve can exhaust oil from the end of the clutch supply valve faster than it can be replaced through the feed orifice. Therefore, the spring force returns the valve to the blocking position. In the blocking position, neither clutch can be fed and both clutches are exhausted at the clutch supply valve, thus causing a neutral condition to exist in the transmission.

NOTE: Latest Allis-Chalmers models have eliminated the seat dump valve in favor of a mechanical system which returns the selector valve to neutral. As a result of this the external control passage of the clutch supply valve is plugged and there is no way to bleed pressure from the pilot section of the valve. The valve will shift into operating position when the engine starts, and will stay in that position as long as the engine is running. The valve no longer provides a useful function and is retained as part of the control valve for purposes of standardization with the two speed transmission.

Selector Valve

Forward (F) position permits oil to flow to the forward clutch and exhaust reverse clutch. Neutral (N) position permits the selector valve to block oil at the valve and exhaust both clutches. Reverse (R) position permits oil to flow to reverse clutch and exhaust forward clutch.

Converter Regulator Valve

Oil fed to converter from pressure regulator valve is directed to end of converter regulator valve. Any time force from oil on the end of the valve exceeds spring force, the valve opens to feed oil to lube and clutch cooling circuit.

Clutch Orifice and Flyball

Clutch cylinders or pistons are provided with either bleed holes or bleed holes and ball dump valve. These are provided to exhaust oil from the clutch cylinder and assure clutch release. Centrifugal force could cause pressure build-up within the clutch cylinder if bleeds were not provided. The flyball bleed provides fast release and permits higher apply pressure.

B. SERVICE

At the truck lubrication period, open the trap door in the floor plate and check the oil level of the transmission sump by use of the dipstick. Engine must be running for this check. Add automatic transmission fluid, if necessary, to bring the oil level up to the FULL mark on the dipstick. When so noted (every 1000 hours of operation), the transmission sump should be drained and refilled with new oil.

CAUTION: DO NOT OVERFILL TRANSMISSION.

No specific time intervals are given, but the shift control adjustment should be checked on occasion.

The transmission operating pressures should be checked whenever the unit is not operating efficiently or after any internal parts have been replaced. Make certain the oil cooler lines are tight. Refer to CHECK-OUT PROCEDURES (TOPIC 2).

Check and adjust the shifting mechanism if necessary. Refer to TOPIC 3.

Refer to TOPIC 4 for transmission oil cooler checks and procedures.

To service the oil filter refer to TOPIC 5. Change oil filter every 200 hours.

At periodic inspections, make sure all mounting capscrews are tight. Make certain no oil is leaking past the output shaft and that the universal joints are tight.

TOPIC 2. POWER SHIFT TRANSMISSION CHECK-OUT PROCEDURES

> NOTE: The transmission oil level must be at the dipstick "FULL" level before performing the following checks. All the checks are made with the transmission oil temperature at 120 - 130°F. Temperatures below 120 - 130°F. will give a reading higher than specified for the individual check.

A. PUMP, TORQUE CONVERTER AND CLUTCH PRESSURES

1. Operate transmission until the transmission oil temperature rises to 120 - 130°F. The required trans mission oil temperature can be reached in a short period of time by operating the transmission with the torque converter stalled. A metal thermometer placed in the oil level dipstick hole can be used to measure the oil temperature.
2. Raise the front of the lift truck until both drive wheels clear the floor, then block into position.
3. Mount a pressure gauge (0 - 300 p.s.i.) in the appropriate pressure tap port for each check. (See Figure 2-1).
4. Attach a tachometer to record the engine speed (RPM). All checks are to be run at the specified engine speed.
5. With the parking brake released, position the transmission in forward and accelerate engine to the specified engine speed. Drive wheel brakes must not drag.

> NOTE: Check pressures at both engine speeds.

6. Check pressure gauge reading. All readings must be a steady value within the pressure range indicated for each pressure check.

Pressure Specifications for Power Shift (single speed) Lift Trucks.

Engine Speed (RPM)	Pump Pressure (p.s.i.) (see Figure 2-1)	Converter Pressure (p.s.i.) (see Figure 2-1)	Clutch Pressure (p.s.i.)* (see Figure 2-1)
600 RPM	40 min. - 110 max.	20 min. - 95 max.	35 min. - 105 max.
2000 RPM	115 min. - 140 max.	75 min. - 115 max.	95 min. - 130 max.

*Check clutch pressure with transmission in forward and reverse.

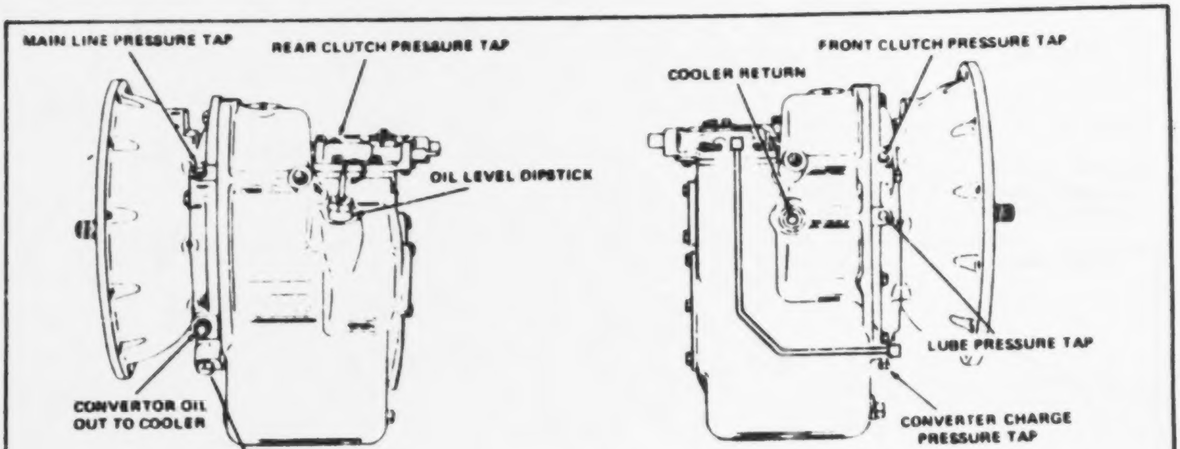

MAIN LINE PRESSURE TAP
REAR CLUTCH PRESSURE TAP
OIL LEVEL DIPSTICK
CONVERTOR OIL OUT TO COOLER
OIL COOLER PRESSURE RELIEF VALVE
74880 731335-1
FRONT CLUTCH PRESSURE TAP
COOLER RETURN
LUBE PRESSURE TAP
CONVERTER CHARGE PRESSURE TAP

Figure 2-1. Pressure Tap Locations

B. INCHING PEDAL

The inching pedal, operated by the left foot, allows slow, creeping maneuvers with full engine speed available for lifting purposes. The more the inching pedal is depressed, the slower will be the truck movement. Full depression of the inching pedal will result in a full stop condition.

If the truck does not come to a full stop when the inching pedal is down, or if the truck does not move smoothly forward with the pedal released, the inching pedal assembly must be adjusted.

> NOTE: Check inching pedal adjustment after every 500 hours of operation.

ADJUSTMENT

1. Remove floor and toe plates.
2. Check brake pedal adjustment and assure it is fully retracted against stop.
3. Adjust inching pedal return spring (Figure 2-2) (10" free length) so that it measures 11" to 11.25" in the retracted position.
4. Adjust the inching pedal stop until the inching valve spool bottoms and the bumper spring is compressed .002" to .0125".
5. Install 0 - 300 psi pressure gauge in reverse clutch pressure port.
6. Raise the front end of the truck and block into position with the front wheels off the floor.
7. Engage parking (hand) brake.
8. Depress the brake pedal until brake shoes contact drum. This will occur when resistance is felt. Use a wedge between the brake stop and pedal to hold it at this position.
9. Start engine . With engine at low idle (500 - 600 rpm) place transmission control lever in R (reverse). Depress inching pedal until pressure gauge reads 6 - 10 psi. Adjust setscrew to make contact with brake pedal lug at this point.
10. Disengage parking brake.

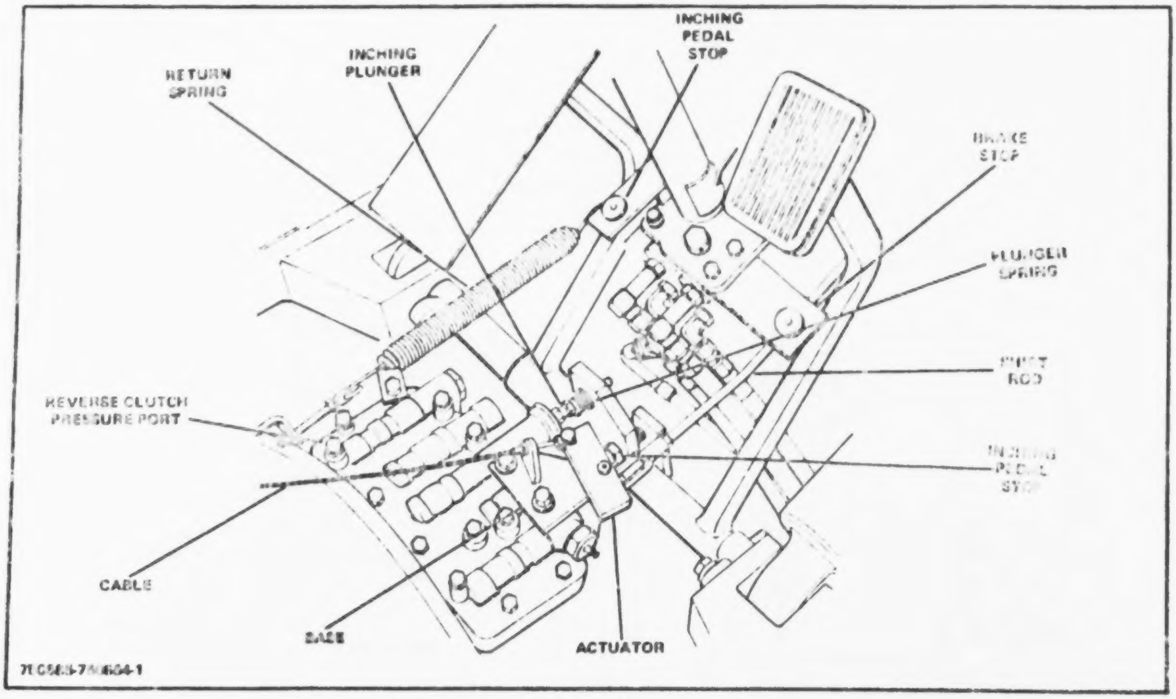


Figure 2-2. Inching Pedal Assembly

TOPIC 3. SHIFTING MECHANISM

The shifting mechanism, located on the steering column shaft, is made up of many parts (Figure 3-1), the primary purpose of which, is to provide a simple means of selecting the desired direction of travel.

There are three positive, detented positions associated with the shifting lever; forward, neutral and reverse. The shifting lever is connected to the control valve assembly on the transmission through a shifting rod and associated linkage. Depending on the position of the shifting lever, (other than neutral) the control valve will respond by pressuring the forward or reverse pistons in the clutch pack assembly.

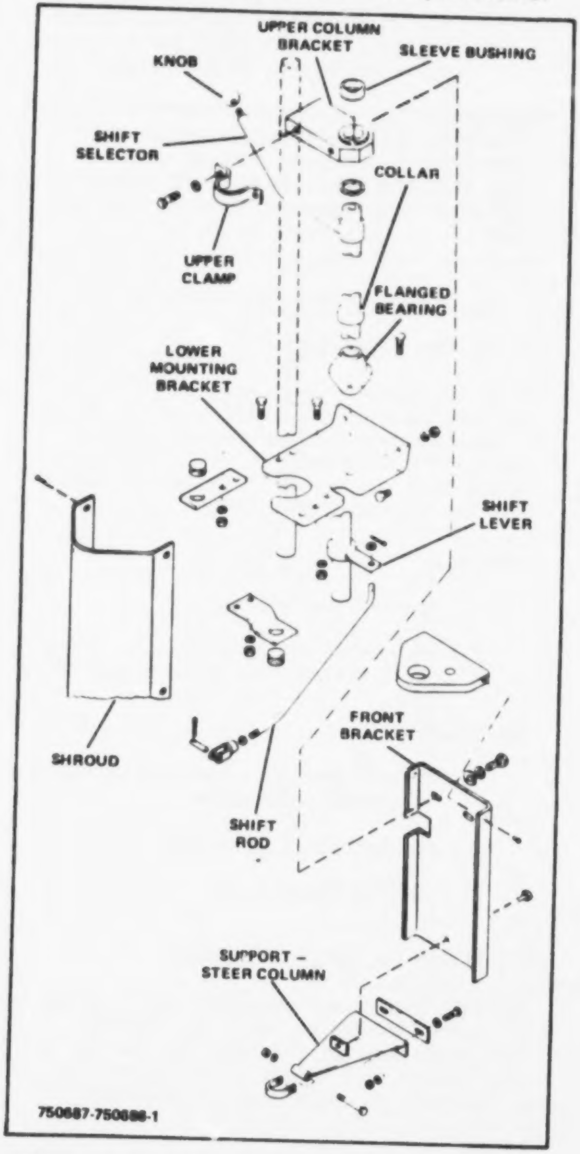

UPPER COLUMN BRACKET
SLEEVE BUSHING
KNOB
SHIFT SELECTOR
COLLAR
UPPER CLAMP
FLANGED BEARING
LOWER MOUNTING BRACKET
SHIFT LEVER
SHROUD
FRONT BRACKET
SHIFT ROD
SUPPORT - STEER COLUMN
750687-750686-1

Figure 3-1. Forward-Reverse Lever Assembly

NOTE: The engine cannot be started unless the FORWARD-REVERSE lever is in its NEUTRAL position due to a safety switch integral to the shifting mechanism.

A. REMOVAL

1. Remove floor and toe plates.
2. Remove shroud.
3. Remove cotter pin and washer from shift rod and remove rod from shift lever. Unless service of the shift rod is necessary, do not disconnect shift rod from transmission. If necessary to remove rod, refer to RETURN TO NEUTRAL MECHANISM below.
4. Remove hardware from flanged bearing. Loosen setscrew on collar. Lower selector lever out of upper column bracket and remove from truck.
5. Remove capscrews holding upper clamp to bracket. Remove clamp.
6. Remove capscrews securing upper column bracket to front bracket and remove upper column bracket.
7. If it becomes necessary to remove the shift lever proceed as follows:
   a. Mark the position of the shift lever.
   b. Loosen clamp screw at shift lever.
   c. Slide shift lever, flanged bearing and collar off bottom of shaft.

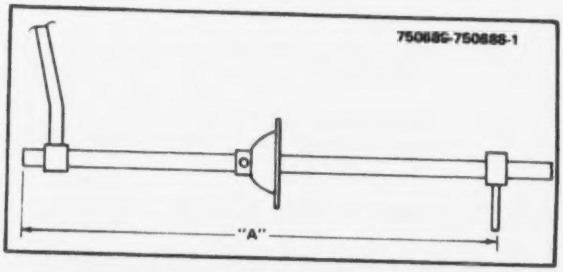

750685-750688-1
"A"

Figure 3-2. Shift Lever Dimension

8. Inspect all mechanical parts for wear or damage and repair or replace as necessary.

B. INSTALLATION

1. If shift lever was removed, slide collar on shaft. Install flanged bearing on shaft with flanged end down. Install shift lever on shaft and position it at location previously marked.
2. If the location was not marked, position lever so that it points in direction opposite to the shift selector handle and adjust to the dimension indicated in Figure 3-2.
3. For ACC20-120 and ACP20-30 trucks the "A" dimension (Figure 3-2) is 29.06". For ACP40-80 trucks the "A" dimension is 30.12".
4. Install upper column bracket on front bracket and secure with capscrews. Install clamp on bracket.
5. Install selector lever and shaft through lower and upper mounting brackets. Position flanged bearing on lower bracket and secure with capscrews. Slide collar down to flanged bearing and tighten setscrew.
6. Connect shift rod to shift lever and secure with washer and cotter pin.
7. Ensure that all mechanical connections have been made and that all connections are properly secured.
8. Start the lift truck engine.
9. Operate the shift control lever and check alignment of the installation. If shifting is difficult stop the engine.
10. If binding is noticed, recheck alignment of upper bracket to shift selector shaft.
11. Check shift rod adjustment (Paragraph C below).
12. When smooth shifting is assured, install shroud and floor and toe plates.

C. ADJUSTMENT - SHIFT SELECTOR

If the truck does not shift into reverse, neutral and forward smoothly and completly, the shift selector assembly should be adjusted according to the following procedure.

1. With the engine off, remove floor and toe plates.
2. Using shift selector on shaft, shift into neutral.
3. In neutral position the shift lever should be perpendicular to a line drawn between the ends of the shift rod.
4. If it is not perpendicular, adjust the length of the shift rod (using threaded end and yoke) until the proper relationship is established.

CAUTION: Be sure threaded end of shift rod does not protrude through yoke and out the other side of yoke. If it does, selector valve movement will be restricted.

5. Replace floor and toe plates.

D. NEUTRAL START SWITCH

Vechicles equipped with power-shift transmissions have a neutral start switch which allows the engine to be started only in neutral. No adjustment is required. Check to see that the switch is threaded tightly into the transmission valve.

REMOVAL

1. Remove floor plate.
2. Disconnect wires and remove neutral start switch from transmission valve.

INSTALLATION

1. Install neutral start switch securely in transmission valve.
2. Connect wires to switch.
3. Install floor plate.

E. RETURN TO NEUTRAL MECHANISM

The lift trucks are equipped with a return to neutral mechanism. When the operator leaves the seat of the truck the spring and linkage will return the transmission to neutral. No adjustment is required.

REMOVAL

1. Raise seat deck and remove floor plate.

2. Remove cotter pin and clevis pin and disconnect cable from actuator See Figure 3-3.

3. Remove retaining ring and disconnect cable from base.

4. Remove capscrews securing bracket and remove upper unit from truck.

5. Remove lower pin and disconnect shift rod from actuator. Remove shoulder bolt and remove actuator from base. Remove bushing from actuator.

6. Remove capscrews and remove base from transmission valve.

7. Check all mechanical parts for wear and damage. Repair and replace as necessary.

INSTALLATION

1. Assemble upper unit and mount bracket on truck.

2. Install base on transmission valve. Use flat washers under base to raise base unit above valve body.

3. Install bushing into actuator. Mount actuator on base and secure with shoulder bolt and lock nut.

4. Position cable on actuator and secure with clevis pin and cotter pin.

5. Secure cable to base assembly with retaining ring.

6. Install floor plate and lower seat deck into position.

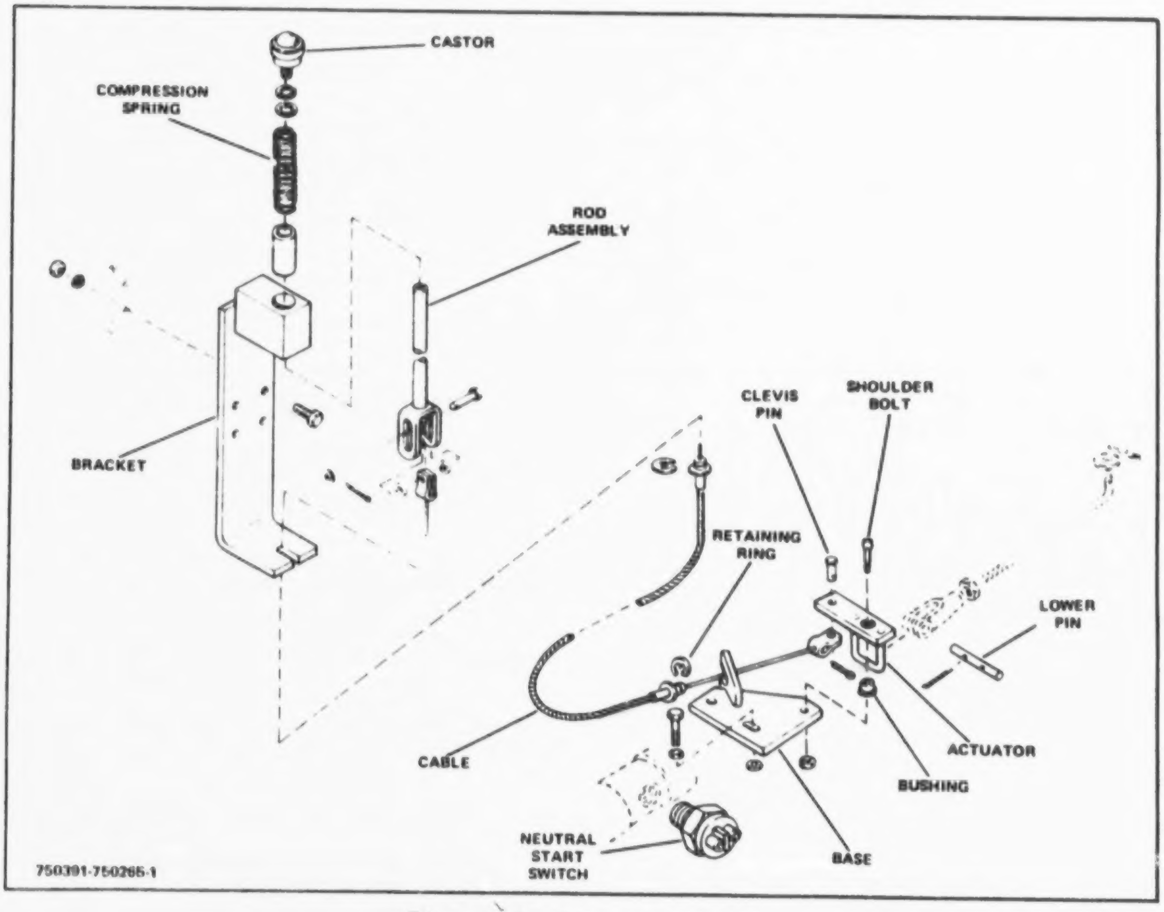

CASTOR
COMPRESSION SPRING
ROD ASSEMBLY
BRACKET
CLEVIS PIN
SHOULDER BOLT
RETAINING RING
LOWER PIN
CABLE
ACTUATOR
BUSHING
NEUTRAL START SWITCH
BASE
750391-750265-1

Figure 3-3. Return to Neutral

MEMO

8. Inspect all mechanical parts for wear or damage and repair or replace as necessary.

B. INSTALLATION

1. If shift lever was removed, slide collar on shaft. Install flanged bearing on shaft with flanged end down. Install shift lever on shaft and position it at location previously marked.
2. If the location was not marked, position lever so that it points in direction opposite to the shift selector handle and adjust to the dimension indicated in Figure 3-2.
3. For ACC 35-55 trucks the "A" dimension (Figure 3-2) is 29.06". For ACP 40-50 trucks the "A" dimension is 30.12".
4. Install upper column bracket on front bracket and secure with capscrews. Install clamp on bracket.
5. Install selector lever and shaft through lower and upper mounting brackets. Position flanged bearing on lower bracket and secure with capscrews. Slide collar down to flanged bearing and tighten setscrew.
6. Connect shift rod to shift lever and secure with washer and cotter pin.
7. Ensure that all mechanical connections have been made and that all connections are properly secured.
8. Start the lift truck engine.
9. Operate the shift control lever and check alignment of the installation. If shifting is difficult stop the engine.
10. If binding is noticed, recheck alignment of upper bracket to shift selector shaft.
11. Check shift rod adjustment (Paragraph C below).
12. When smooth shifting is assured, install shroud and floor and toe plates.

C. ADJUSTMENT - SHIFT SELECTOR

If the truck does not shift into reverse, neutral and forward smoothly and completly, the shift selector assembly should be adjusted according to the following procedure.

1. With the engine off, remove floor and toe plates.
2. Using shift selector on shaft, shift into neutral.
3. In neutral position the shift lever should be perpendicular to a line drawn between the ends of the shift rod.
4. If it is not perpendicular, adjust the length of the shift rod (using threaded end and yoke) until the proper relationship is established.

CAUTION: Be sure threaded end of shift rod does not protrude through yoke and out the other side of yoke. If it does, selector valve movement will be restricted.

TOPIC 4. OIL COOLER

An oil cooler is installed in the Power-Shift transmission system to control the temperature of the oil. The cooler unit is located in the bottom tank of the radiator. If oil appears in the engine coolant, it indicates a leak has developed in the oil cooler. Cooler must be repaired or replaced immediately. See Figure 4-1.

NOTE: Refer to COOLING SYSTEM for RADIATOR REMOVAL, REPAIR and REPLACEMENT.

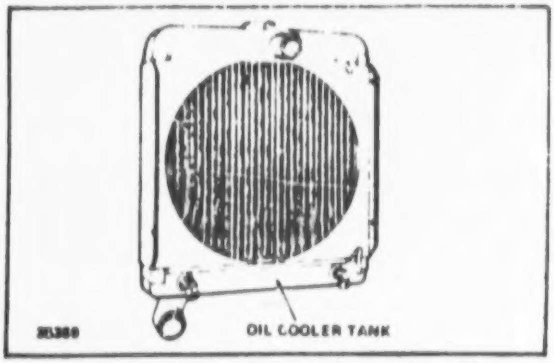


Figure 4-1. Oil Cooler Location

TOPIC 5. OIL FILTER

A. DESCRIPTION

An oil filter is installed as standard equipment in all Power-Shift transmissions. The purpose of the filter is to eliminate harmful contaminants from the oil and to increase the service life of the transmission. The filter is installed in the return line between the oil cooler and the transmission. It is the throw-away, replaceable type and it is recommended that it be changed every 200 hours. Changing the filter at the prescribed interval will help keep the transmission free of contaminants.

B. SERVICE

1. Operate the transmission until the oil temperature reaches the normal operating point. (About 10 - 15 minutes.)
2. Gain access to the oil filter by raising the seat deck and removing the side panel.
3. Using an oil filter removing tool, unscrew the filter (refer to Figure 5-1) and discard.
4. Clean all oil and sediment from the filter base. Be sure all traces of lint are removed if a rag is used to clean parts.
5. Apply a light coat of oil to the rubber gasket on the filter. Screw replacement filter onto filter base and hand tighten only.

CAUTION: Do not use the removing tool to replace the oil filter.

6. If oil has been drained, replace with automatic transmission fluid (Type "A", Suffix "A") to the FULL mark on the dipstick.
7. Start the engine, set the parking brake, and run for about 5 minutes. With engine running and transmission in neutral (N), check the transmission oil level with the dipstick.

CAUTION: Be sure the parking brake is set.

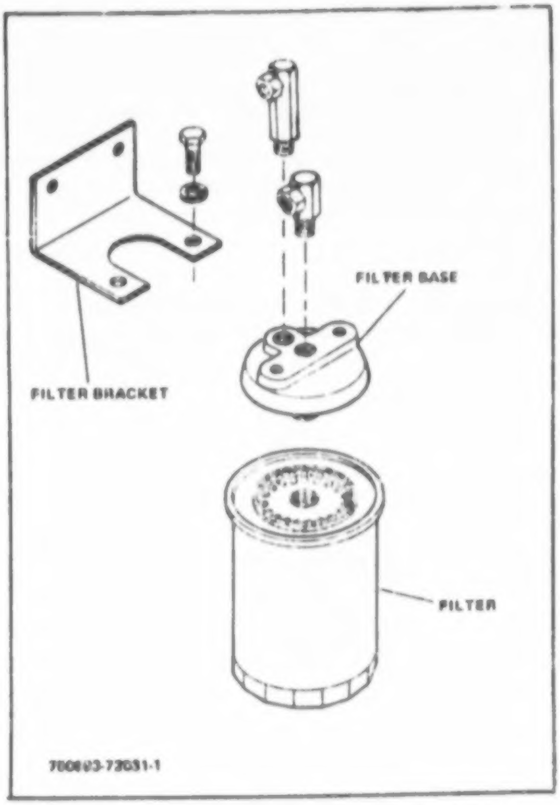


Figure 5-1. Throw-Away Filter (Typical)

8. If oil level is below the FULL mark, add automatic transmission fluid (Type "A", Suffix "A") until oil reaches FULL mark on oil dipstick, (about one quart for oil filter).

CAUTION: Do not overfill the transmission. Overfilling can cause damage to the transmission seals.

9. After filling transmission with oil, check for oil leakage around the gasket area and hoses. Correct any leaks found.
10. Install side panel and lower seat deck.

MEMO

TOPIC 1. UNIVERSAL JOINT

A. GENERAL

The purpose of the universal joint assembly is to transfer the transmission output power to the drive wheels of the truck. The universal joint assembly is the heavy duty industrial type which consists of a drive shaft or center plate, two cross assemblies, a transmission output flange, and the necessary hardware.

B. 100 HOUR INSPECTION

As a preventive maintenance check, it is recommended that the torque of the universal joint capscrews be checked periodically. The mounting capscrews (Fig 1-1 or 1-2) that secure the cross assemblies together, and the joint attaching capscrews, must be tightened to specified torque of 25-30 lb-ft DRY THREADS, or 20-24 lb-ft LUBRICATED THREADS.

C. 500 HOUR SERVICE

Lubricate universal joint bearings with specified grease by means of grease fittings in the cross assemblies.

NOTE: The universal joint, on some units, is not equipped with grease fittings; it must be disassembled before the bearings in the cross assembly can be packed properly with specified grease.

D. REMOVAL

1. Raise and securely block the lift truck to gain access to the universal joint assembly.

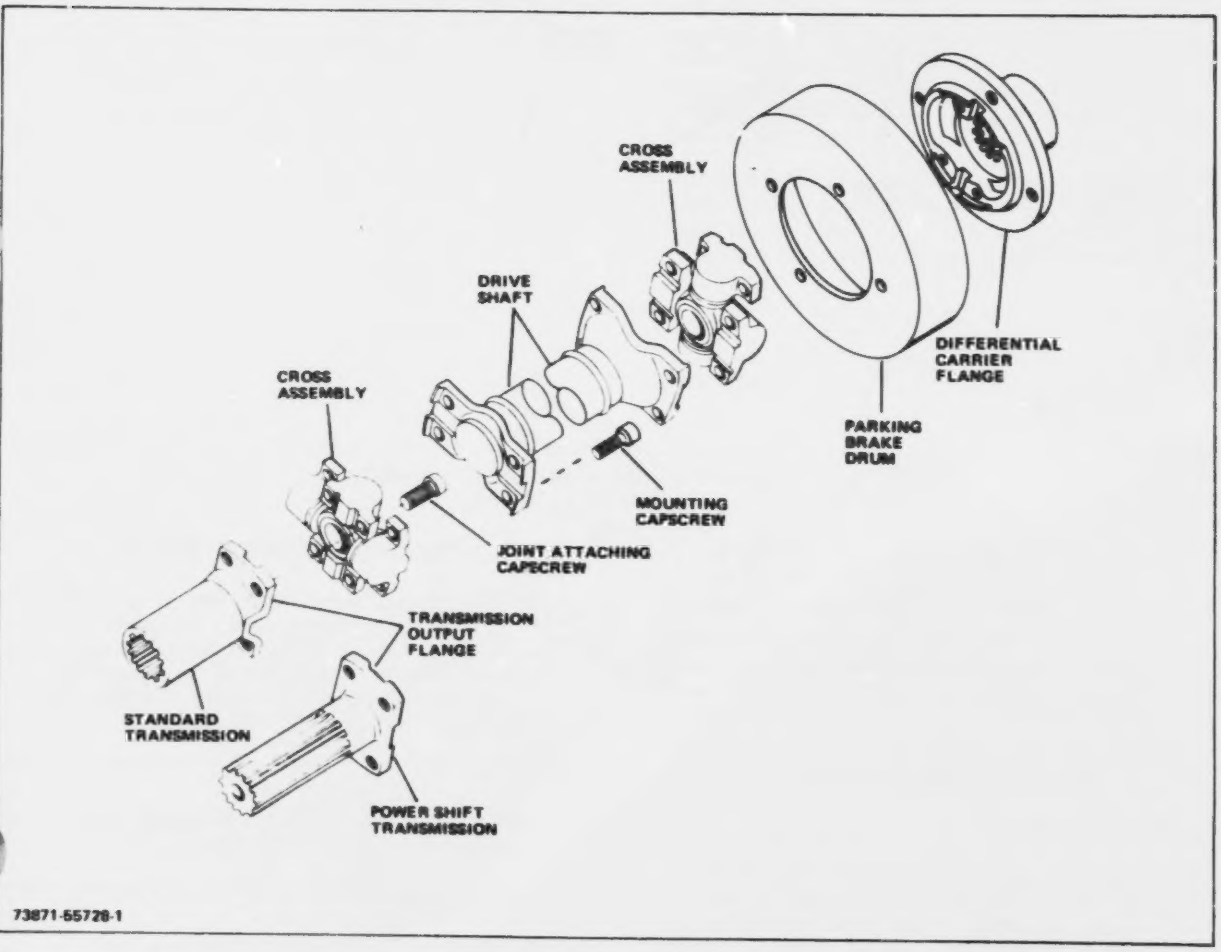

CROSS ASSEMBLY
DRIVE SHAFT
DIFFERENTIAL CARRIER FLANGE
CROSS ASSEMBLY
PARKING BRAKE DRUM
MOUNTING CAPSCREW
JOINT ATTACHING CAPSCREW
TRANSMISSION OUTPUT FLANGE
STANDARD TRANSMISSION
POWER SHIFT TRANSMISSION
73871-65728-1

Figure 1-1. Universal Joint Assembly
(Typical)

best copy available

Reproduced from poor document.

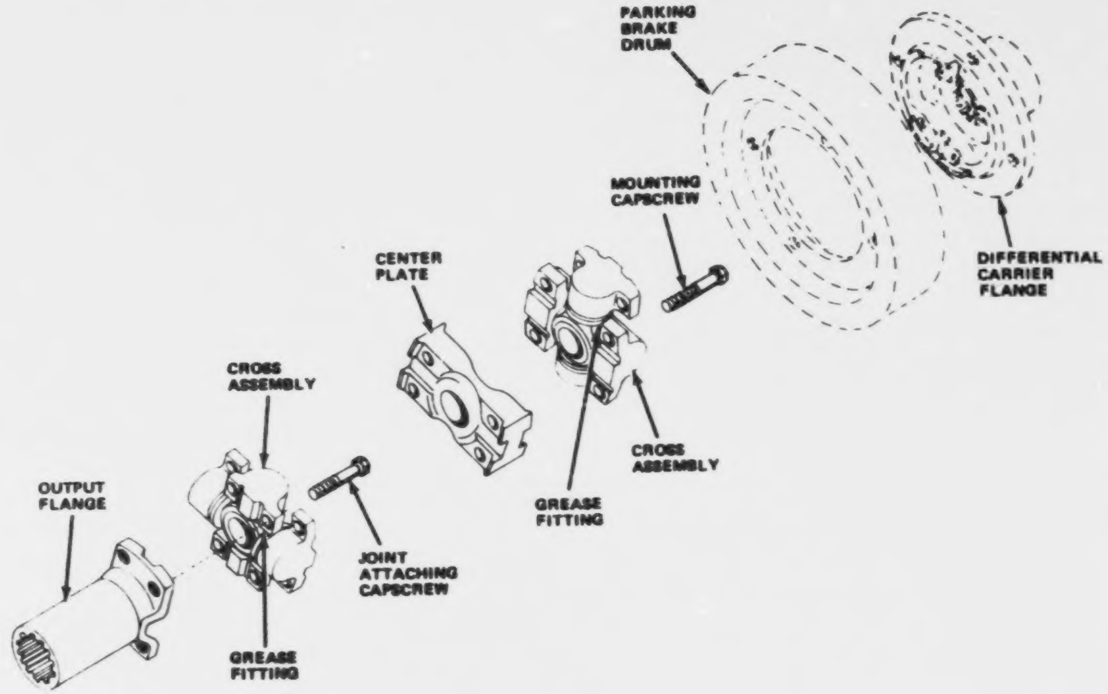

PARKING BRAKE DRUM
MOUNTING CAPSCREW
DIFFERENTIAL CARRIER FLANGE
CENTER PLATE
CROSS ASSEMBLY
CROSS ASSEMBLY
OUTPUT FLANGE
GREASE FITTING
JOINT ATTACHING CAPSCREW
GREASE FITTING
73322-66978-1

Figure 1-2. Universal Joint Assembly
(ACP 100-120-140)

2. At the transmission end of the assembly, remove the capscrews that attach the cross assembly to the output flange.
3. At the differential end of the assembly, remove the capscrews that attach the cross assembly to the differential carrier flange.
4. Remove the entire universal joint assembly from the lift truck.

E. INSTALLATION

1. Position the differential end of the universal joint so the holes in the cross assembly align with the holes in the differential carrier flange. Insert capscrews and tighten them to specified torque of 25-30 lb-ft DRY THREADS, or 20-24 lb-ft LUBRICATED THREADS.
2. Position transmission end of universal joint so holes in cross assembly align with holes in output flange. Insert capscrews and tighten them to specified torque of 25-30 lb-ft DRY THREADS, or 20-24 lb-ft LUBRICATED THREADS.

NOTE: Make certain ALL CAPSCREWS are tightened to SPECIFIED TORQUE.

3. Remove blocks supporting the lift truck and lower the truck to the floor.

DRIVE AXLE

TOPIC 1. DRIVE AXLE

A. DESCRIPTION

The drive unit is a double reduction, internal gear drive within wheel, and a spiral bevel in axle housing. The drive wheels are mounted on an axle housing spindle by two opposed tapered roller bearings, locked in correct adjustment by a washer, a castellated nut and cotter pin. The weight of the truck is carried by the axle housing, and through the wheels (See Figure 1); therefore, the axle shafts serve only to drive the wheels.

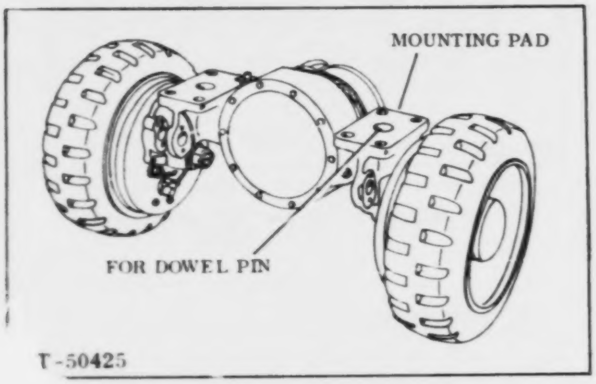


Figure 1. Drive Axle Assembly (Typical)

The differential is of the bevel gear and pinion type with the final drive reduction through the axle shafts (jackshaft) and bull gears (Figure 2), setting each drive wheel into motion. In order to hold the differential assembly rigidly in place in the housing, it is mounted on two studs and then held firmly in position by self-locking capscrews.

The axle shafts (jackshaft) are splined to the differential side gears at one end and mesh with the bull gear in the drive wheel at the opposite end. The axle shaft teeth are crown-shaved to ensure proper meshing with the bull gear. The axle shafts rotate at the drive wheel end in two opposed tapered roller bearings, which are locked in place on the shafts by a sleeve type nut and spider lock ring. The assembly is locked in position in the axle housing by a bearing cap and capscrews.

The bull gear is correctly located in the drive wheel by roll pins and is bolted into the wheel from the outside so that tightness can be checked periodically without the necessity of removing the wheel.

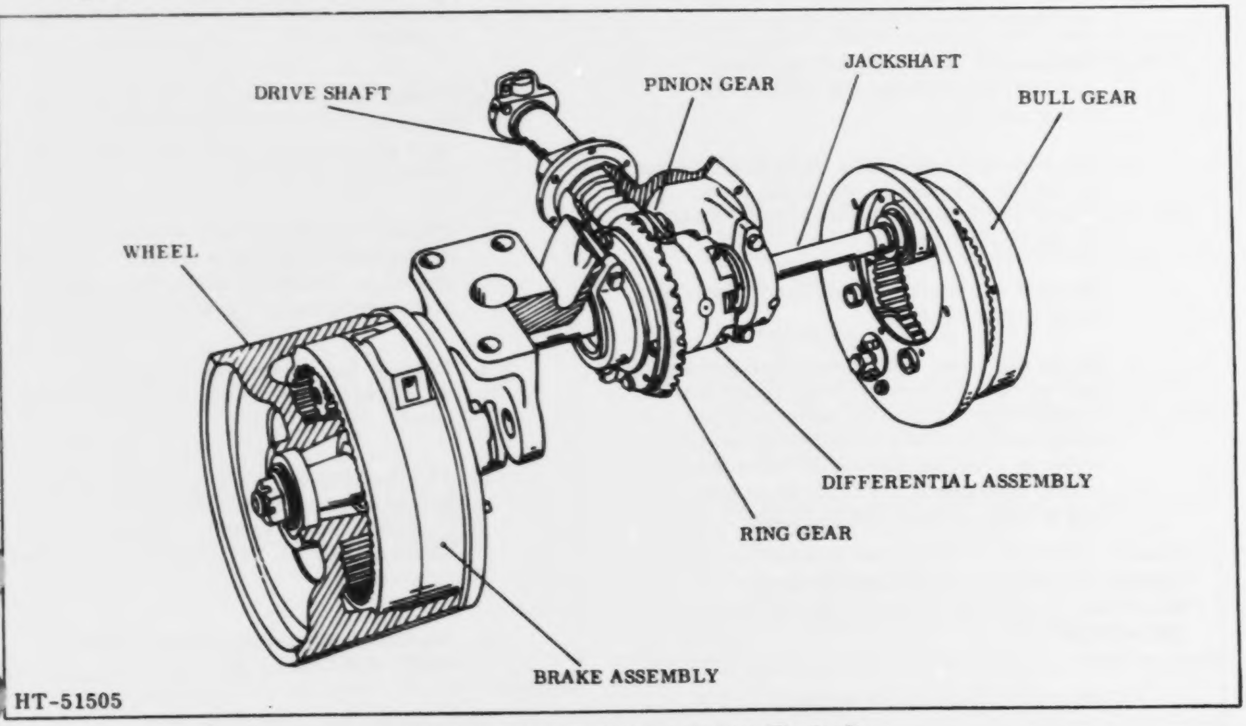


Figure 2. Drive Unit Components (Typical)

B. DRIVE UNIT SERVICE

Jackshafts and bearings, bull gears and wheel bearings should be inspected and serviced at periodic intervals. All parts should be checked for any possible damage or excessive wear. The level of the oil in the differential housing should be checked, and also changed when specified.

The housing breathers should be kept clean and open to prevent any pressure from building up in the unit.

NOTE: Refer to the LUBRICATION AND SERVICE GUIDE for specific instructions regarding lubrication of the drive unit.

The drive unit can be removed as an assembly, if desired. It will be necessary to remove the mast assembly in order to remove the drive unit. The following procedure is recommended for drive unit removal:

1. Removal

   a. After the mast has been removed (see MAST REMOVAL), disconnect the main hydraulic brake line at the junction block located on the differential housing. Disconnect the hydraulic lines, the leakage return line, or any other lines which are attached to the drive unit housing.

   b. Disconnect the emergency brake cable by removing the clevis pin from the parking brake actuating lever.

   c. Disconnect the universal joint (see U-JOINTS), leaving slip joint in the transmission.

   d. See Figure 3 and attach hoist chain hooks in the tilt cylinder holes in the front plate. Pull chain snug to take the weight of the truck off drive axle.

   e. Remove all mounting bolts and capscrews from mounting pads.

   f. Raise the truck away from the drive unit and remove drive unit from under the truck frame. It may be necessary to apply pressure at the mounting pads in order to free the drive unit from the truck, because of the tight fit of the dowel pins in the mounting pads.

NOTE: For service instructions on the drive unit assembly, refer to DRIVE UNIT DISASSEMBLY.

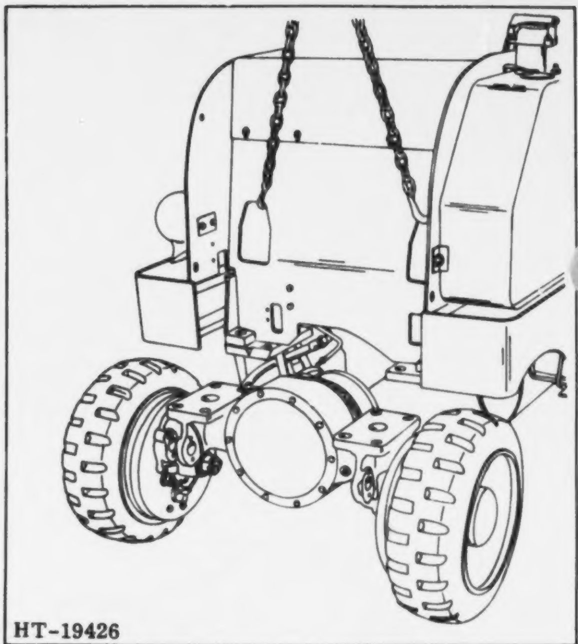

HT-19426

Figure 3. Drive Unit Removal

2. Installation

   a. To replace the drive unit assembly, carefully raise the truck body high enough with hoisting chain to position drive unit under front end at dowel pin location.

   b. Lower truck frame until it is securely supported at the mounting pads and insert all mounting bolts and capscrews previously removed.

   c. Connect universal joint and ensure that drive shaft coupling is properly aligned. (Refer to TRANSMISSION for proper alignment procedure.)

   d. Connect the emergency brake cable by replacing the clevis pin at actuating level.

   e. Securely tighten all mounting hardware and hose connections and bleed the hydraulic brake system. (Refer to HYDRAULIC BRAKE Section for proper procedure.)

   f. Replace the mast assembly. (Refer to MAST ASSEMBLY Section.)

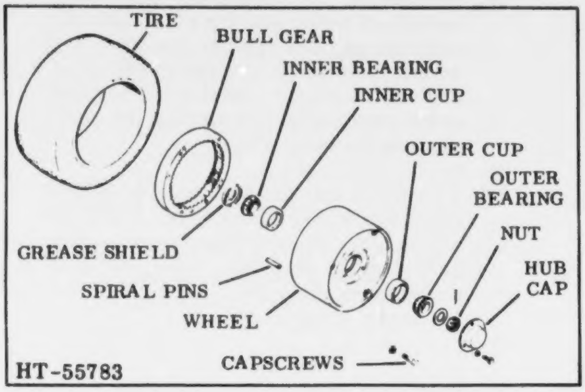

TIRE
BULL GEAR
INNER BEARING
INNER CUP
OUTER CUP
OUTER BEARING
NUT
HUB CAP
GREASE SHIELD
SPIRAL PINS
WHEEL
CAPSCREWS
HT-55783

Figure 4. Drive Wheel Assembly

C. DRIVE UNIT DISASSEMBLY

The following operations may be performed without removing the drive unit from the truck.

1. Drive Wheel Removal

The wheel assembly consists of the wheel, tire, brake drum, wheel bearings and the bull gear. (Figure 4.)

To remove the wheel:

a. Raise the truck sufficiently so that the drive wheel clears the floor. This may be done by tilting the mast to its full backward position and inserting a block under the mast assembly, then tilting mast to its vertical position. (See Figure 5.)

b. Remove capscrews, lockwashers and hub cap. Remove cotter pin, washer and retaining nut. The outer wheel bearing can now be removed.

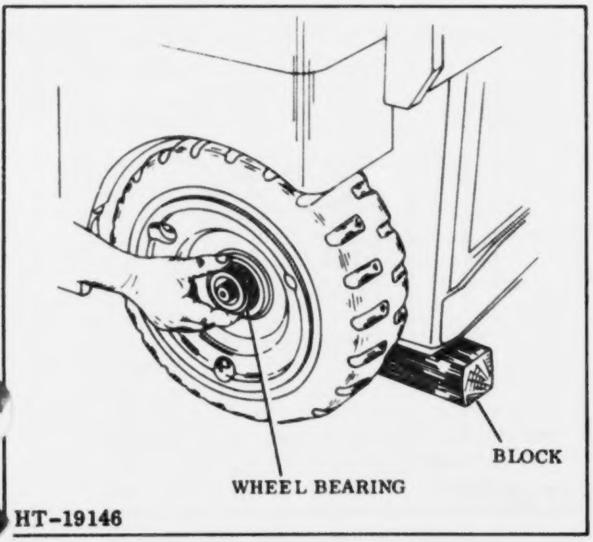

WHEEL BEARING
BLOCK
HT-19146

Figure 5. Removing Wheel Bearing

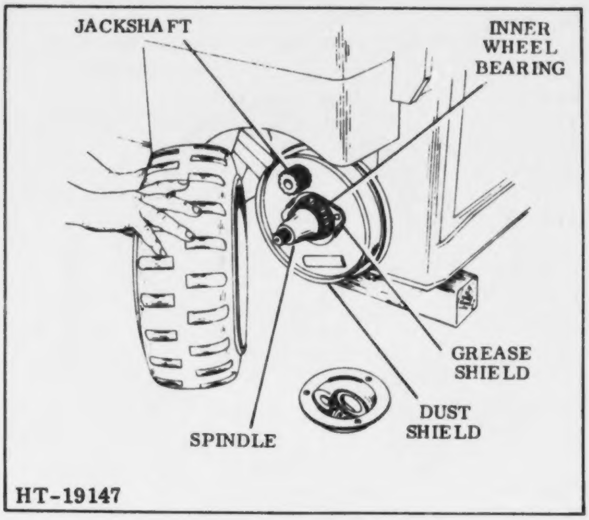

JACKSHAFT
INNER WHEEL BEARING
GREASE SHIELD
DUST SHIELD
SPINDLE
HT-19147

Figure 6. Removing Drive Wheel

c. After the outer wheel bearing has been removed, the wheel can be removed. (See Figure 6.)

> CAUTION: When removing wheel, exercise care so that no damage to the drum or brake shoes occurs.

d. After the drive wheel has been removed, the inner wheel bearing and the grease shield can be removed.

2. Inspection - Service

Using a solvent, wash all grease from the bearings and bearing surfaces. Inspect for worn or damaged parts and replace where necessary.

a. Replacing Bearing Cups

(1) Recesses are provided on the inner hub of the drum; insert a brass drift at these points, tap lightly with a hammer and remove cup.

(2) When replacing bearing cups, set in hub with taper to the outside of the wheel. Using a brass drift, tap evenly around the edge of the cup, exercising care so that the cup will not bind (bearing press can also be used for installation).

> NOTE: Bearing cup should be a press fit.

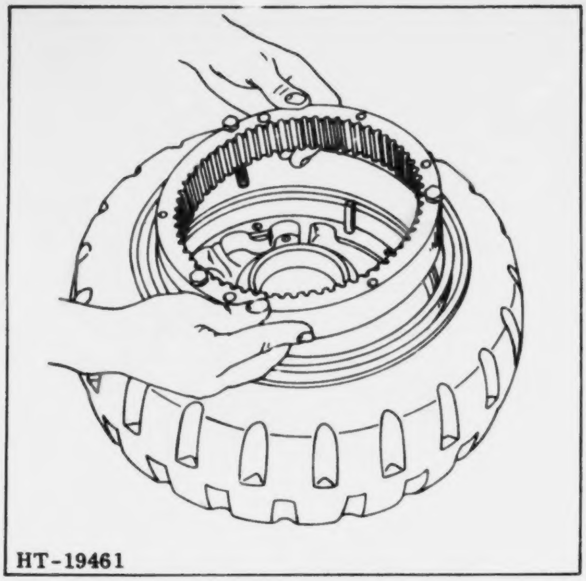


Figure 7. Bull Gear Removed

b. Replacing Bull Gears

(1) Remove the three capscrews which bolt the bull gear to the inner side of the wheel.

(2) Turn the wheel over and using standard, hardened capscrews with three inches of thread, insert in the holes provided in the bull gear. (Figure 7.)

(3) Tighten the capscrews evenly until the bull gear is removed from the wheel bore.

(4) Inspect the bull gear for any broken or worn teeth or cracks in the ring. Replace if damaged.

(5) To prevent any damage to the bull gear when installing the spiral pins, the edge of the outer coil should lie on the bolt circle diameter as shown in Figure 8.

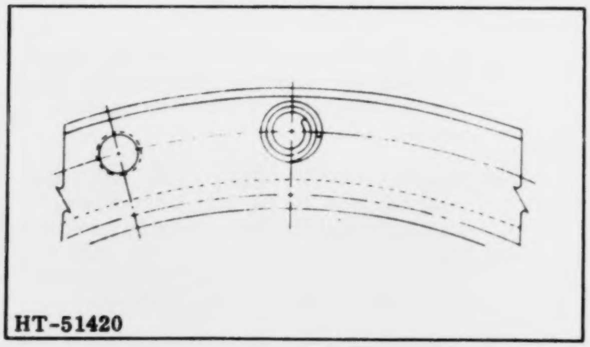


Figure 8. Spiral Pin Installation

(6) To reinstall the bull gear, align the spiral pin holes and the pins, and tap until the gear is started into the wheel. Install capscrews originally removed and continue gear installation by tightening capscrews and tapping the bull gear at the same time.

(7) To ensure that the bull gear is seated correctly in the wheel bore, try to insert a .003" feeler gauge between the gear and the shoulder. When the gear is properly seated, the feeler gauge will not enter at any point.

c. Replacing Solid or Cushion Tire

The wheels used on all cushion tire lift trucks are machined from a casting. Any misalignment of the wheel and tire, while pressing the wheel into the tire, can cause possible damage to the wheel. Because of this, a chamfer has been provided on the outside edge of the wheel and on either end of the metal insert located on the inside diameter of the tire. The chamfers help center the wheel and tire for pressing and reduce the possibility of any misalignment. The chamfered edge of the wheel must always be the leading edge of the wheel when the wheel is being pressed into the tire.

When replacing worn or damaged tires the wheel chamfer is not noticeable. To assure that the chamfered edge enters the new tire first always position the new tire on top of the wheel and tire assembly with the outside of the wheel and tire assembly up.

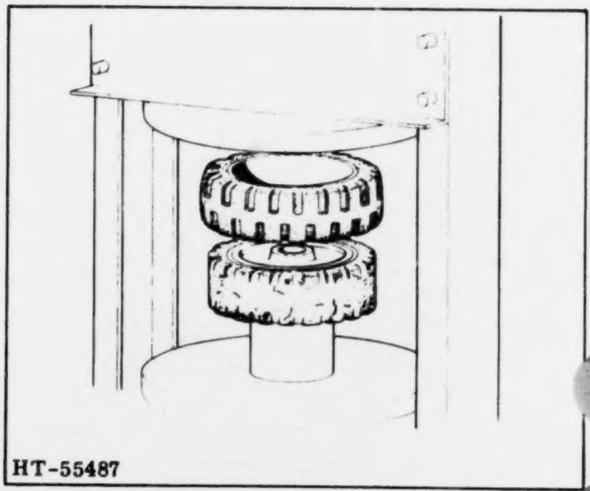


Figure 9. Tire Replacement

The following procedure is recommended to replace cushion tires.

(1) Remove wheel and tire assembly from lift truck.

(2) Check inside diameter of new tire. Remove any signs of scale or rust with sandpaper. Lubricate inside of new tire with bearing grease.

(3) Place a circular ram on the press table. The length of the ram must be greater than the width of the tire to allow complete removal of the old tire. The outside diameter of the ram must be large enough to rest squarely on the bull gear's flat surface .

(4) If the outside edge of the wheel is not flush with the edge of the metal insert in the old tire, measure how far wheel is recessed inside the tire. New tires must be replaced to the same position as the worn tire was installed on the wheel. A spacer, slightly smaller in diameter than the inside diameter of the tire and the same thickness as the depth of the recess, can be used to obtain the proper amount of recess.

(5) Center worn tire and wheel assembly over ram, be sure ram and wheel "mate-up" squarely.

(6) Position new tire on top of wheel and tire assembly. Align new tire and wheel and tire assembly to be concentric with each other. Make certain the outside of the wheel is positioned upwards, because the outside edge of the wheel has a slight chamfer to help guide the wheel into the new tire.

NOTE: The tire can only be installed in one direction without risking damage to the wheel.

(7) Start pressing new tire onto wheel and worn tire off the wheel. Run press slowly for the first inches of travel because this is the critical stage of pressing wheel into tire. If tire begins to cock, stop press and realign wheel and tires, a sharp jar with a mallet will normally realign wheel and tire. If the wheel is to be recessed in the tire, stop hydraulic press after the wheel has been started into the new tire and position the spacer on the inside diameter of the new tire. The spacer must rest squarely on the outer edge of the wheel. Continue pressing new tire onto wheel until tire is correctly positioned on wheel.

(8) Release press and remove tires. Inspect new tire and wheel assembly.

(9) Install wheel and tire assembly on lift truck.

3. Jackshaft Service

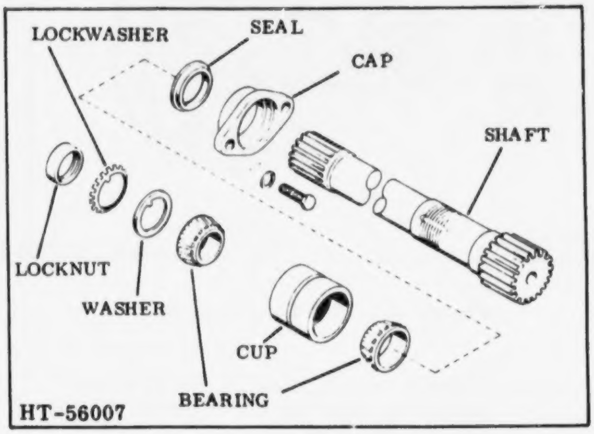


Figure 10. Jackshaft Assembly

The jackshaft is the connection between the differential assembly (first reduction) and the bull gear in the drive wheel (second reduction). The jackshaft is supported by two opposed, tapered roller bearings; its splined end fits into the differential and the opposite pinion end drives the wheel through the bull gear. To remove the jackshaft, proceed as follows:

a. Remove wheel. (See WHEEL REMOVAL.)

b. Remove capscrews which secure the jackshaft dust shield.

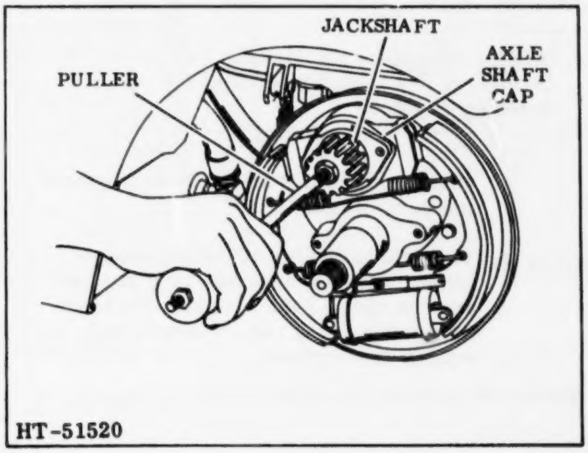


Figure 11. Pulling Jackshaft

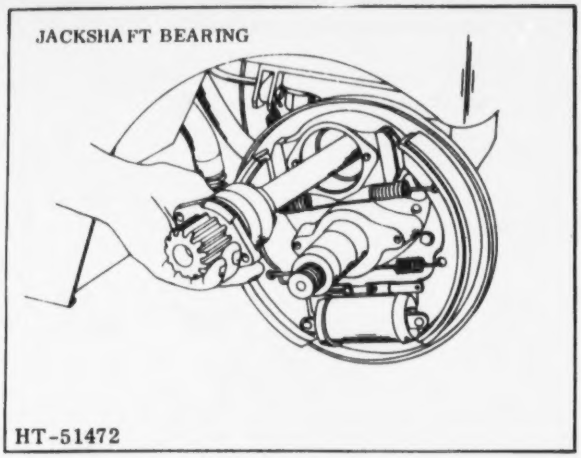


Figure 12. Jackshaft Removed

c. Install a weight puller in the threaded end of the jackshaft and exercising care, remove the shaft.

NOTE: The bearing assembly will be removed with the jackshaft. Figure 12.

d. Straighten the locking prongs of the lockwasher (Figure 10) and remove locknut lockwasher.

e. Place the shaft in a suitable press and force the bearings from the shaft.

CAUTION: Exercise care to prevent damaging the axle shaft cap.

f. After bearings and bearing cup are removed, slide the retainer cap from the shaft.

NOTE: Whenever the jackshaft is removed, it is recommended that the oil seals be replaced.

g. Clean and inspect all parts and replace where necessary.

h. To reassemble the jackshaft components. slide the retainer ring and new seal on shaft. Next, replace the bearings and bearing cup, washer, lockwasher and locknut.

i. Ensure that bearings have been properly packed with grease, then tighten locknut so there is a slight drag on the bearings. Lock the nut in position by bending prongs of lockwasher over.

j. To reinstall the jackshaft, place in position in the drive housing. Then, using a soft mallet, drive the shaft in place, and at the same time align the holes in the retaining cap with the holes in housing. Install and tighten capscrews.

k. Replace wheel.

4. Spindle Service

To remove the drive wheel spindle, proceed as follows:

a. Remove wheel. (See WHEEL REMOVAL).

b. Remove dust cover.

c. Remove the cotter pin, locknut and washer from the spindle at the back side of the drive housing.

d. Install a spindle puller as shown in Figure 13 and remove the spindle.

e. Carefully inspect the spindle for any evidence of uneven wear or damage. Replace if worn, chipped or bent.

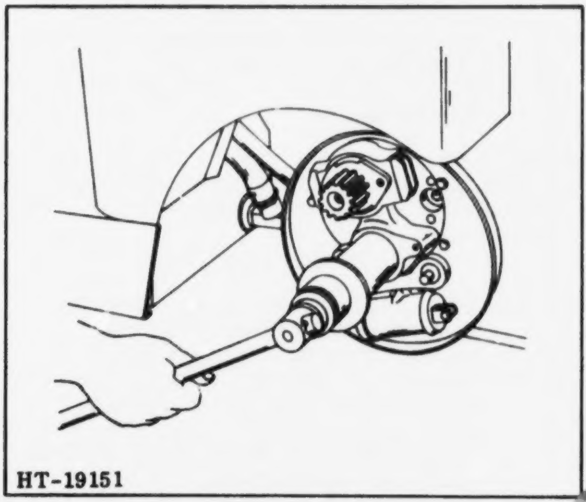


Figure 13. Removing Spindle

f. To replace spindle, align the spindle in the drive housing and replace the washer and locknut. Tighten the nut until the spindle fully seats, then install the cotter pin.

g. Install the dust shield and the wheel assembly.

h. Tighten wheel bearing nuts as follows: Using a torque wrench, tighten nuts in accordance with chart below; just before reaching maximum torque, turn each wheel six times in both directions, then back nut off 30° minimum to 60° maximum so cotter pin can be installed.

TORQUE VALUES:

FT20-25-B30	90 ft. lbs.
F30-40-50	120 ft. lbs.
FP40-50	120 ft. lbs.
F-FS60-70	120 ft. lbs.
FTP20-30	150 ft. lbs.
F-FS80	150 ft. lbs.
F100-120	200 ft. lbs.

TOPIC 2. HYDRAULIC BRAKES

The brake system consists of a mechanically activated hydraulic master cylinder with heavy duty brake lines transmitting hydraulic pressure to the brake wheel cylinders located behind a dust shield in each of the drive wheels. For a complete description of the hydraulic braking system and service procedures, refer to HYDRAULIC BRAKE Section.

TOPIC 3. DIFFERENTIAL

A. DESCRIPTION

The differential case and carrier consists of two parts, the carrier assembly and the differential assembly. (See Figure 14.) The carrier assembly is mounted at the center of the drive unit housing (See Figure 2) and encloses the pinion gear from the drive shaft. The bevel ring gear is bolted to the differential case and the case in turn houses the spider gears.

It is the purpose of the differential and carrier assembly to accept and translate the driving torque from the drive shaft coupling to the drive wheels of the lift truck, thus moving the truck in a forward or reverse direction. The following procedure is recommended to remove the differential assembly from the carrier.

B. REMOVAL

1. Remove the drive wheels; refer to DRIVE WHEEL REMOVAL.
2. Remove the jackshafts; refer to JACKSHAFT REMOVAL.
3. Remove U-Joint and drive shaft coupling; refer to U-JOINTS, REMOVAL.

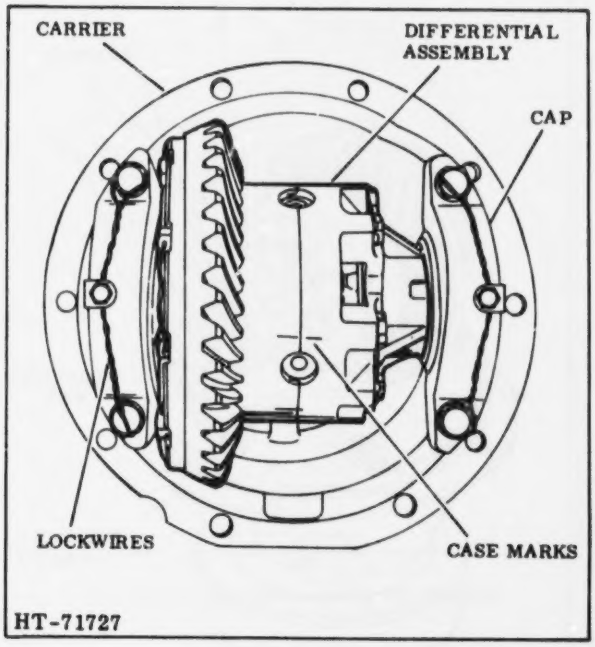


Figure 14. Differential and Carrier Assembly

4. Remove drain plug at bottom of differential housing assembly and drain oil.

5. Remove the parking brake cable at the brake actuating lever and disconnect the hydraulic lines or leakage return line if they might hinder differential and carrier assembly removal.

6. Remove the securing capscrews which mount the carrier and differential assembly to the axle housing.

WARNING: Be sure to properly support the carrier assembly as the capscrews are removed.

7. Carefully withdraw the carrier and differential assembly from the axle housing and place on a suitable workbench.

NOTE: It may be necessary to lightly tap the carrier housing in order to free it from seal.

8. Remove and discard gasket between carrier housing and axle housing.

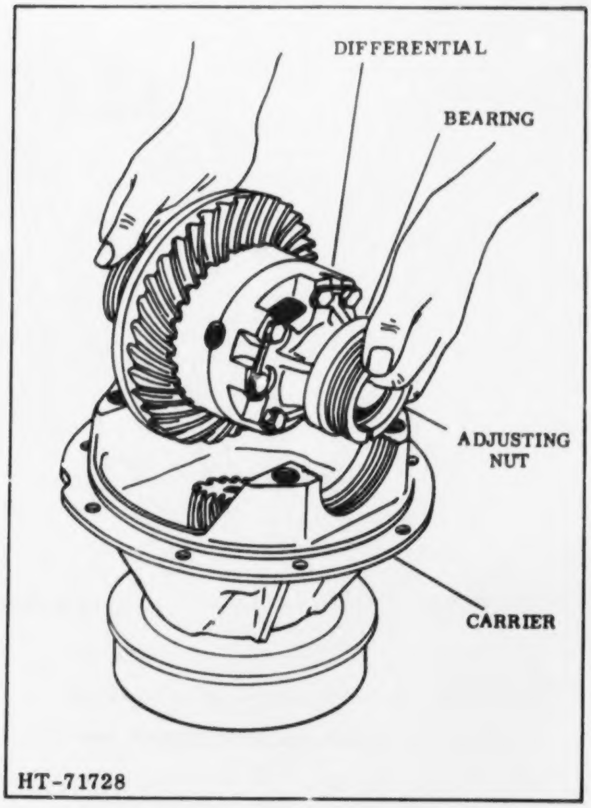


Figure 15. Removing Differential from Carrier

9. Mark the bearing caps and differential housing (Figure 14) to aid in proper alignment during reassembly; then remove the lockwire securing capscrews, cotter pins and the retaining bearing caps.

10. Refer to Figure 15 and remove the differential case assembly along with the adjusting nuts, bearings and bearing cups.

NOTE: Refer to DIFFERENTIAL and CARRIER DISASSEMBLY Section, REPAIR MANUAL for proper INSPECTION and REPAIR-REPLACEMENT Procedures.

C. INSTALLATION

1. Refer to Figure 15 and install the differential case assembly along with adjusting nuts, bearings and bearing cups in the same relative positions as these components were prior to removal.

2. After ensuring that the ring gear has meshed with the pinion gear, replace the bearing caps, but do not tighten.

CAUTION: Make sure the bearing caps are reinstalled as marked at time of disassembly.

3. Coat the ring gear with Prussian Blue or white lead to obtain the tooth pattern.

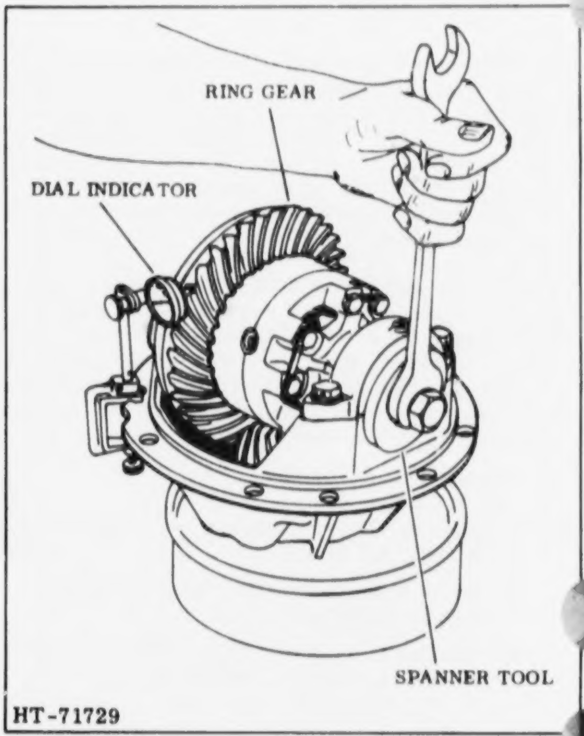


Figure 16. Adjusting Backlash

4. Adjust the ring gear laterally for a backlash adjustment of .005" to .010" (backlash etched on gear) by means of the differential side bearing adjusting nuts. To increase the backlash, loosen the adjusting nut nearest to the ring gear, and tighten the opposite nut. To decrease the backlash, reverse above operation by loosening far sided nut and tightening adjusting nut nearest to ring.

   The differential side bearings must not be set any tighter than that which will produce a maximum pull of 3 to 5 lbs. on a string wrapped around the compensating case.

5. With the drive pinion properly installed and adjusted, rotate the pinion and hold back on the ring gear to create the effect of a load. After several rotations of the drive pinion, inspect the teeth of the pinion where the paint has been removed by gear contact. Compare the tooth bearing (area where paint was removed) with Figure 17. The tooth bearing should start at a point about 1/32" to 1/16" from the top of the tooth and continue downward to a point about 1/32" to 1/16" from the bottom of the tooth.

NOTE: Do not be concerned with the amount of paint removed from the front toward the rear of the tooth. The amount of paint removed is determined by the amount of load applied while rotating the drive pinion and ring gear. The tooth bearing should always be more toward the toe end, or a toe bearing.

Explanation of Figure 17:

a. Correct adjustment.

b. Heavy contact on toe of tooth. To correct this misalignment, move the ring gear away from the pinion within backlash limits. Move pinion towards ring gear to again obtain the the correct backlash.

c. Bearing too low; heavy contact on flank of tooth. To correct this misalignment, move the pinion gear away from the ring gear until contact comes to the full working depth of gear tooth without breaking contact at flank. Move the ring gear towards the pinion to obtain the proper backlash.

d. Heavy contact at heel of tooth. To correct misalignment, move the ring gear towards the pinion. Move pinion away from pinion to obtain correct backlash.

e. Shows heavy contact on tooth face. Move pinion towards gear until contact covers flank of tooth without breaking contact at face. Move gear away from pinion to secure correct backlash.

6. After proper backlash and tooth pattern are obtained, fully tighten capscrews holding bearing caps in place and wire in position.

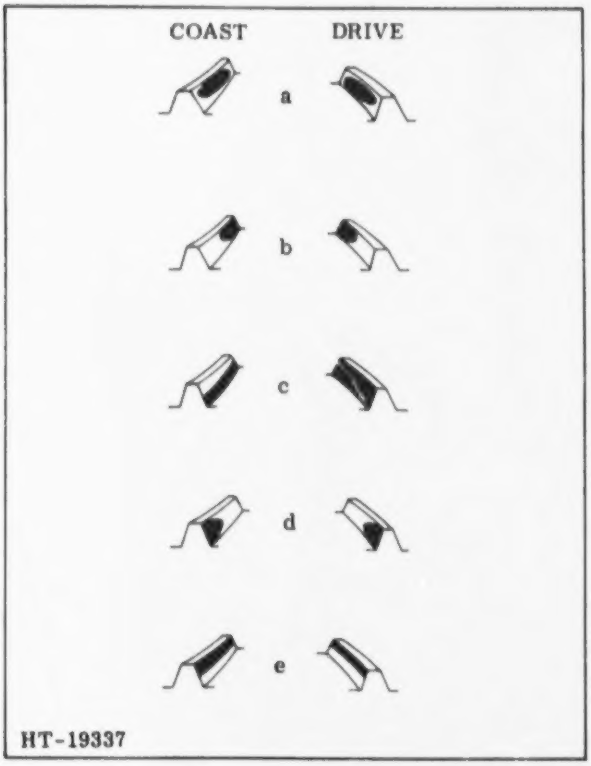


Figure 17. Differential Tooth Pattern

7. Install adjusting nut lock and align with hole in adjusting nut. Secure to cap with capscrew and lockwasher.

8. Position new gasket on mounting flange of differential and coat with a suitable leak-proof adhesive.

9. Install differential assembly in drive unit and install capscrews.

> NOTE: Use copper washers on capscrews located beneath oil level of differential.

10. Connect the parking brake cable at brake drum lever and connect the hydraulic lines and leakage return line if disconnected during disassembly.

11. Replace the drain plug in bottom of differential housing assembly and fill differential with proper S. A. E. oil to recommended capacity.

12. Replace U-Joint and drive shaft coupling; refer to U-JOINTS, INSTALLATION.

13. Install jackshafts; refer to JACKSHAFT INSTALLATION.

14. Install drive wheels; refer to DRIVE WHEEL INSTALLATION.

MEMO

MEMO

BRAKE SYSTEM

TOPIC 1. BRAKES

A. DESCRIPTION

The hydraulic brakes are the type referred to as "semi-floating, self-centering," and are specially designed for lift truck applications. The hydraulic brake system consists of a mechanically activated hydraulic master cylinder with heavy duty brake lines transmitting hydraulic pressure to brake wheel cylinders located between the brake shoes of each drive wheel. The double ended wheel cylinders have links extending from each side of the cylinder which transmit the movement from the wheel cylinders to the brake shoes.

The tops of the brake shoes move freely in a brake wear plate while the bottoms of the shoes transfer movement from the hydraulic wheel cylinders. (See Figure 1.)

No manual adjustment of the brake shoes is required as the system incorporates self adjusting brakes through use of a friction operated link assembly in each wheel. (See Figure 2.) The friction in the link assembly is great enough to prevent the shoe return springs from collapsing the link, but not great enough to prevent the brake pedal pressure from expanding it. The link assemblies are

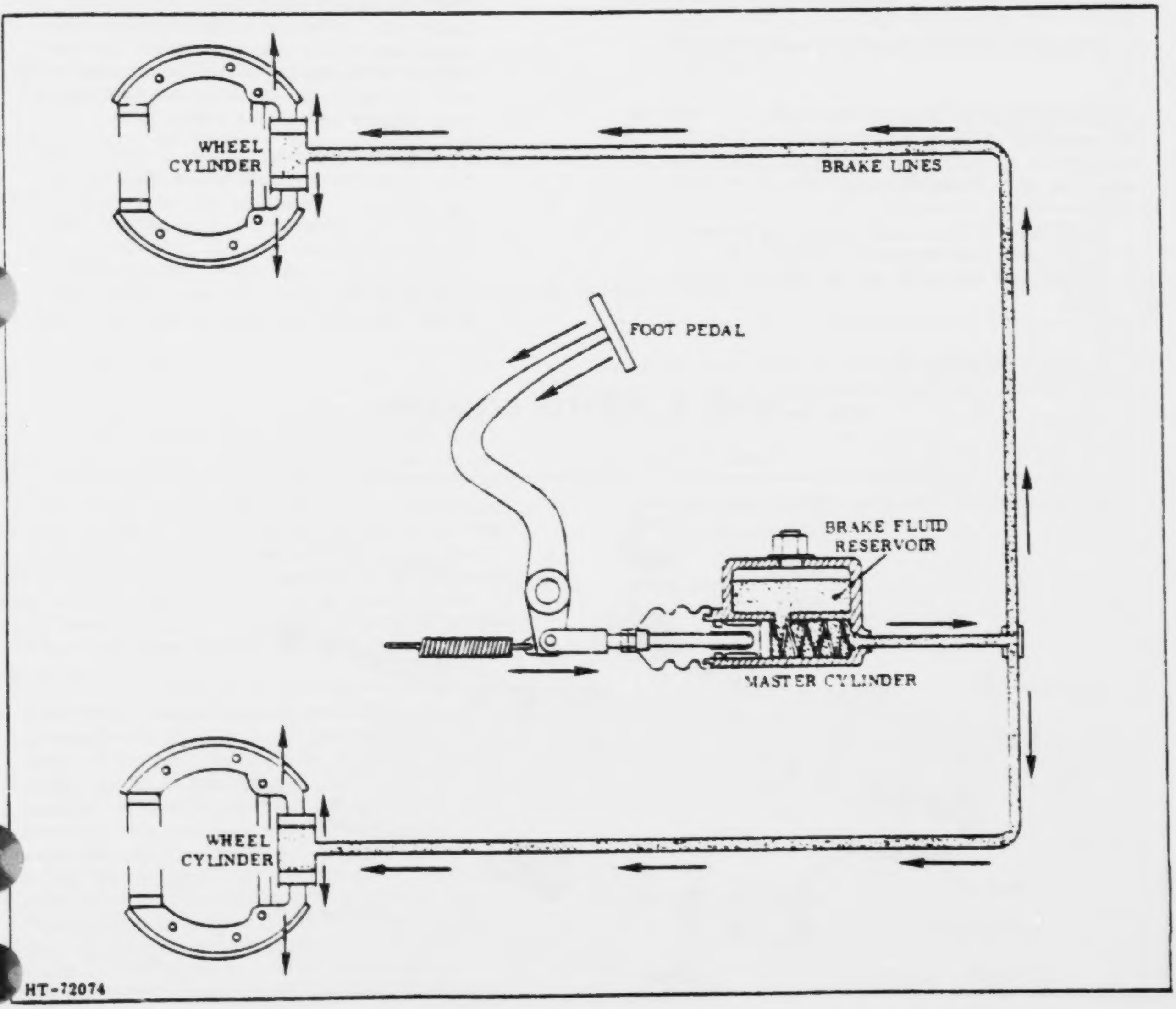


Figure 1. Hydraulic Brake System

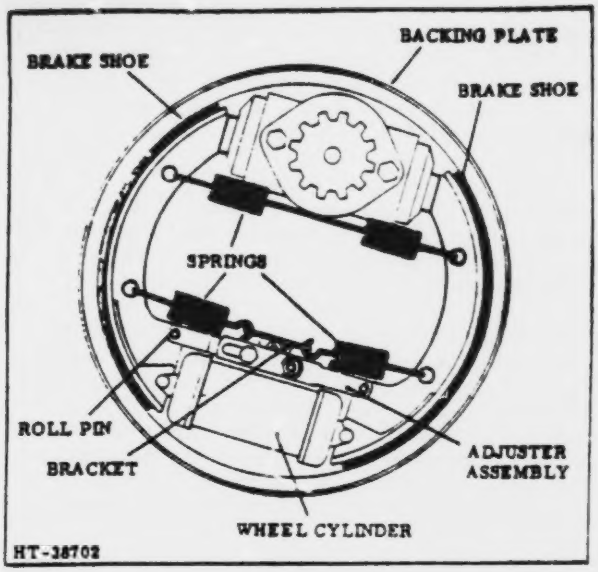

BACKING PLATE
BRAKE SHOE
BRAKE SHOE
SPRINGS
ROLL PIN
BRACKET
ADJUSTER ASSEMBLY
WHEEL CYLINDER
HT-38702

Figure 2. Self-Adjusting Brakes (Typical)

attached to the brake shoes with roll pins, and the pin mounting holes in the brake shoes are 1/32" oversize to provide proper working clearance between the shoe lining and brake drum.

> **CAUTION:** If link is not operating properly, install new link assembly. Links are factory-set and must not be adjusted in the field.

1. **Operation of Wheel Cylinders and Brake Shoes:**

   The first requisite for safe, sure hydraulic braking is the use of high quality brake fluid. The hydraulic brake system requires a "solid column of fluid" and the fluid should possess essential protective properties which safeguard the system.

> **CAUTION: Use only a premium quality, heavy-duty brake fluid with an extreme "heat-cold" range. SAE specification R-71 is recommended.**

Hydraulic fluid entering the wheel cylinders from the master cylinder forces pistons to move individually and in opposed directions. This piston travel expands the brake shoes. As the pressure increases, the piston cup lips are forced more tightly against the cylinder wall, effecting a positive fluid seal, neglecting minor friction looses; the controlled actuating force is equal to and varies with the hydraulic pressure exerted against each square inch of the piston face.

The pistons are returned to an "off" position by the force of the brake shoe retracting springs. The piston cup lips are pressed against the cylinder walls by natural resiliency and system residual pressure to seal against fluid or air leaks. The hydraulic pistons of the wheel cylinders follow the brake shoes as they expand into the drums.

TOPIC 2. MASTER CYLINDER

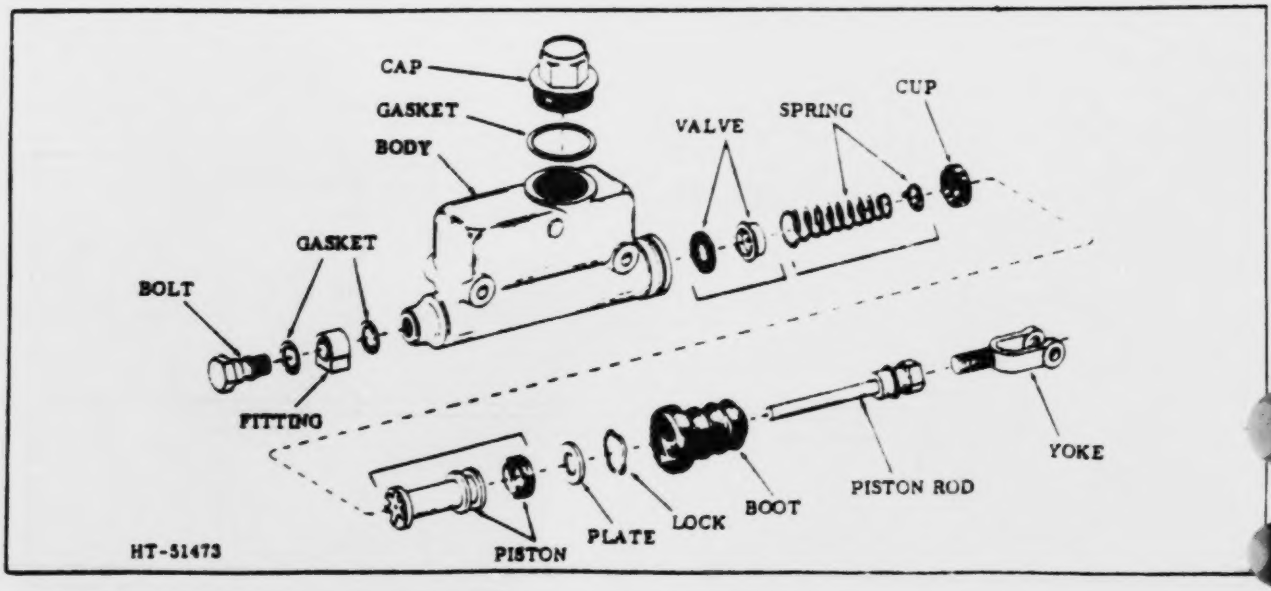

CAP
GASKET
BODY
VALVE
SPRING
CUP
GASKET
BOLT
FITTING
PISTON
PLATE
LOCK
BOOT
PISTON ROD
YOKE
HT-51473

Figure 3. Master Cylinder Assembly

A. DESCRIPTION

The master cylinder and hydraulic fluid reservoir are combined in one casting and are joined by intake and by-pass ports located in the cylinder wall. (See Figure 3.) Internal parts are removed or installed at the push rod end of the cylinder. The stop plate holding the internal parts is retained by a lockwire clipped into the cylinder bore. The cylinder piston is operated through a push rod connected to the brake pedal. The push rod and cylinder opening is enclosed with a rubber boot.

It is impractical to thoroughly clean the cylinder and fluid reservoir on the truck. For this reason the following instructions should be observed:

B. REMOVAL

1. Remove floor and toe plate.
2. Disconnect brake hydraulic line attached to master cylinder.
3. Remove clevis pin holding the pushrod to the brake pedal assembly.
4. Remove capscrews that mount the master cylinder to the inside of the truck frame and remove.

NOTE: Refer to REPAIR MANUAL for MASTER CYLINDER, INSPECTION, DISASSEMBLY, REPAIR and REASSEMBLY.

C. INSTALLATION

1. Ensure that master cylinder is completely reassembled prior to installing.
2. Replace master cylinder assembly in its relative mounting location and install securing capscrews.
3. Attach brake pedal pushrod to cylinder and secure with clevis pin previously removed.
4. Connect brake hydraulic line to cylinder.
5. Refer to LUBRICATION CHART and fill cylinder with proper high grade hydraulic brake fluid. SAE specification R-71 is recommended.
6. Bleed brake system as outlined under appropriate heading, REPAIR MANUAL.
7. Replace floor and toe plate.

TOPIC 3. DRIVE WHEEL BRAKES

A. DESCRIPTION

The brake shoes are self-adjusting through the use of a friction operated self-adjuster in each drive wheel. The friction between the two slide assemblies of the self-adjuster is great enough to prevent the brake shoe springs from fully retracting the self-adjuster, but not great enough to prevent the hydraulic pressure from expanding it. The self-adjuster assembly is mounted to the brake shoes with roll pins. The roll pin holes in the brake shoes are 1/32" oversize to provide proper working clearance between the brake shoe lining and drum.

CAUTION: Exercise care when self-adjuster is handled or installed. Do not bend the tangs of the slide assemblies in any way because the holes for the roll pins must be parallel with each other. If the holes are not parallel, the roll pins will lie at a slight angle through the mounting holes in the brake shoes. Improper alignment of the roll pins could lead to improper brake shoe retraction due to lack of proper roll pin clearance in the brake shoe holes. This in turn could create brake shoe drag on the drum.

In order for the self-adjusting brakes to operate properly, the self-adjuster assembly must be properly torqued. If it becomes necessary to remove and disassemble the self-adjuster in the field, use the following recommended procedure to assemble the self-adjuster.

B. ADJUSTMENT

1. Assemble components as illustrated in Figure 4.

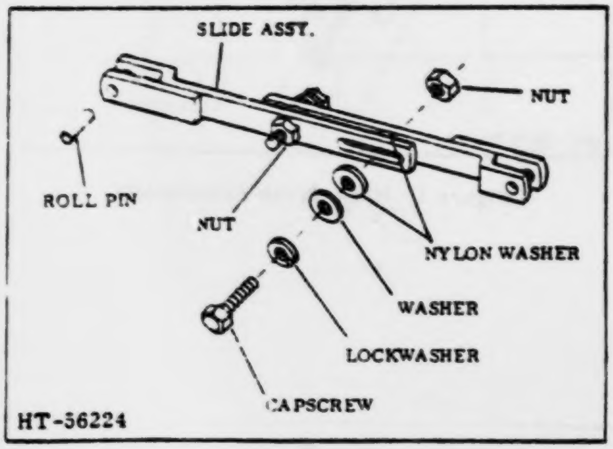


Figure 4. Brake Self-Adjuster Assembly

2. Tighten capscrews (5) to a torque of 14 to 16 in. lbs.

3. Hold capscrews (5) in position and tighten nuts (6) to a torque of 29 in. lbs.

4. Check slip resistance of the slide assemblies, resistance must be 250 to 300 lbs.

5. After the assembly is completed, the self-adjuster should measure 5-1/4" between hole centers when it is fully retracted.

6. Replace drive wheel brake drum assembly and drive wheel; refer to BRAKE DRUM UNIT REASSEMBLY and DRIVE WHEEL REASSEMBLY.

7. To test the operation of the self-adjuster, after initial installation of adjuster unit, place shifting lever in either forward or reverse and step on brake pedal. Self-adjuster should automatically adjust and there should be very little play in brake pedal.

NOTE: If there is excessive play in brake pedal, check pedal adjustment before removing brake drum unit. Refer to DRIVE WHEEL BRAKE ADJUSTMENT, REPAIR MANUAL.

TOPIC 4. PARKING BRAKE

A. DESCRIPTION

A dual shoe mechanical brake, mounted at the drive shaft, can be used as either a parking brake or as an emergency brake. The brake shoes are actuated through a cable by an adjustable, over-center type lever, mounted on the left hand cowl panel. (See Figure 5.)

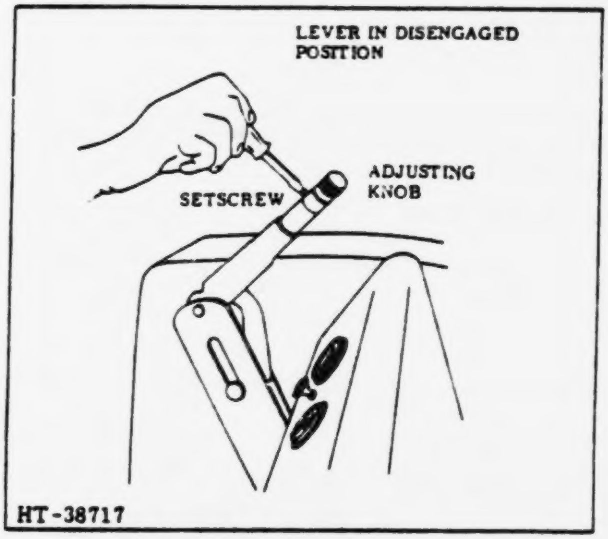


Figure 5. Hand Brake Adjustment

The brake mechanism requires no lubrication except at time of assembly. The brake actuating mechanism, such as the hand lever and linkage, should be lubricated periodically.

B. ADJUSTMENT

To compensate for brake lining wear, the tension on the hand brake can be increased by adjusting the knob on top of the hand brake lever. (See Figure 5.) The following procedure is recommended for proper adjustment of hand brake lever:

1. Set the hand brake lever in the fully released position.
2. Remove the setscrew that locks the adjusting knob in position.
3. Turn the adjusting knob in a clockwise direction one or two turns, then verify adjustment by engaging the brake. Lever should pull harder to engage brake if properly adjusted.
4. Repeat Step 3 if additional tension is required. When satisfactorily adjusted, turn setscrew in to lock the adjusting knob.

NOTE: Refer to REPAIR MANUAL if brake shoe adjustment is required.

POWER STEERING SYSTEM

TOPIC 1. STEERING

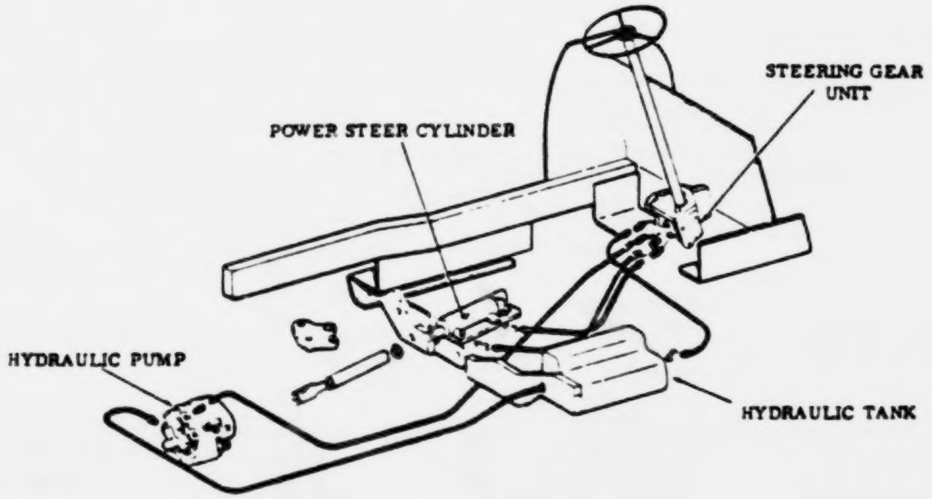
A. DESCRIPTION

Vehicles with power steering have a steering wheel and column, a hydraulically operated steer gear at the base of the column, a hydraulic pump, filter, reservoir, and a power steer cylinder that actuates the drag link. The drag link moves the tie rods which, in turn, transfer movement to the steer wheels at the back of the truck.

The steer wheels turn the truck in the same direction as the steering wheel is turned, but they do this by swinging the back of the truck away from the turn.

The steering wheel and column are similar to standard steer systems, but the gear has ports for the movement of hydraulic fluid. When the steering wheel is turned to the right, fluid flows out of one port in the gear to the forward power steer cylinder port. The fluid forces the piston in the cylinder out, thereby pushing backward on the drag link. The drag link pushes on the pivot arm. The pivot arm turns, moving the tie rods with it. The other ends of the tie rods connect to the spindles on which the steer wheels are mounted. Therefore, the wheels turn.

When the steering wheel is turned to the left, the hydraulic fluid flows out of the other port in the steer gear. This fluid is forced into the back of the power steer cylinder. This forces the piston forward; the piston takes the drag link forward with it. The drag link pulls forward on the pivot arm, and the pivot arm pulls the tie rods and thus steers the wheels into position for a left turn.



HT-52118

Figure 1. Power Steering Components

TOPIC 2. STEER AXLE

A. DESCRIPTION

The steer axle assembly (Figure 2), is attached to the truck frame by two axle mounting housings. (See Figure 3.)

It will be necessary to raise the rear of the truck to remove the steer axle assembly, and the following procedure is recommended:

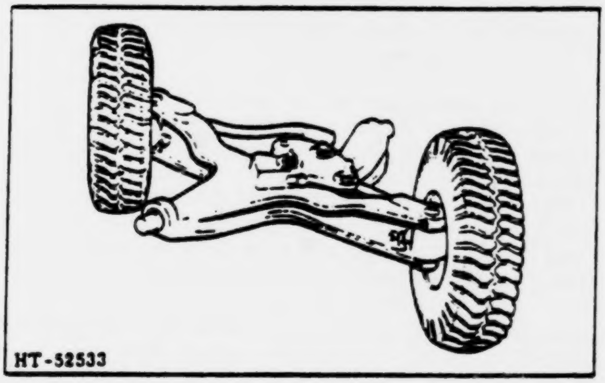


Figure 2. Steer Axle Assembly

B. REMOVAL

1. Raise rear end of truck with chain hoist to a height which makes all parts accessible, and block truck in this position.
2. Remove steer wheels.
3. Place a suitable jack under steer axle and raise slightly to remove stress from axle mounting housings and to support axle during removal.
4. Remove drag link from pivot arm. Refer to DRAG LINK Section.
5. Remove capscrews and locknuts securing axle mounting housings to truck frame.
6. Lower jack and pull steer axle assembly from under the truck.

NOTE: Refer to REPAIR MANUAL for DISASSEMBLY, INSPECTION, REPAIR and REASSEMBLY procedures.

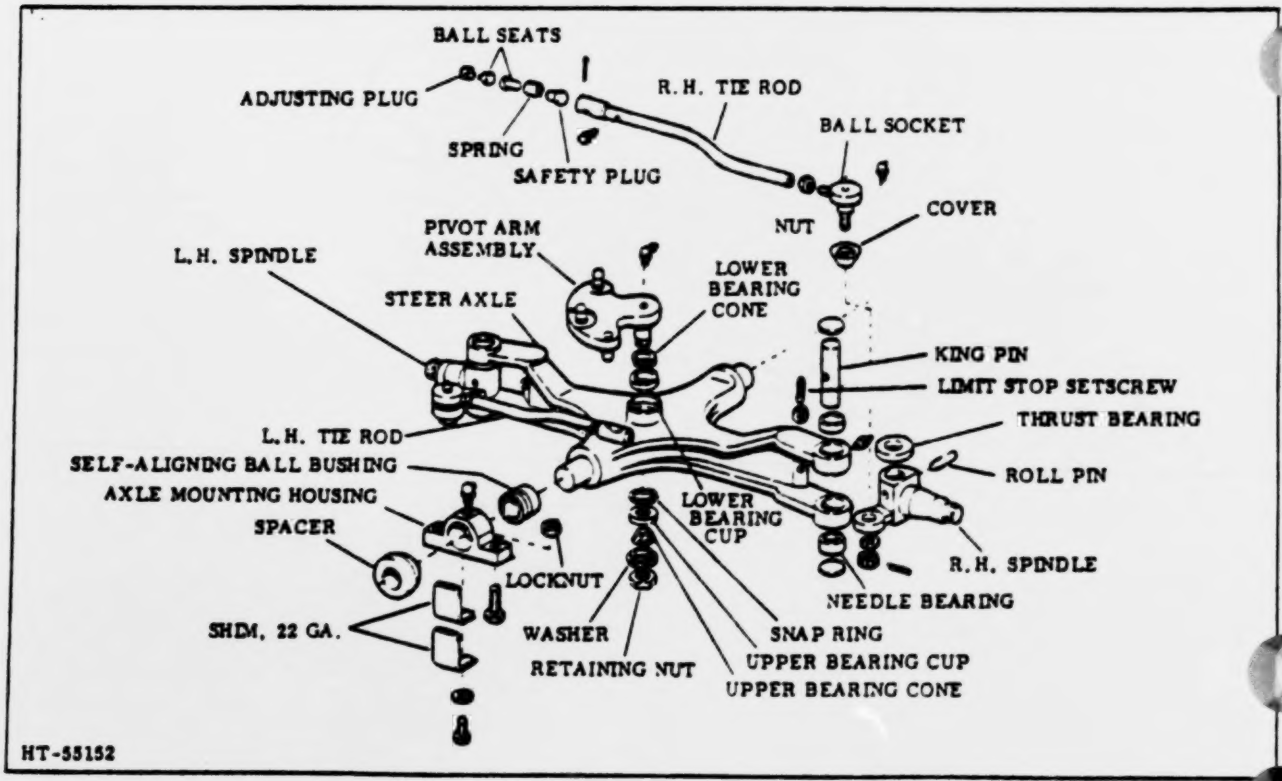

BALL SEATS
ADJUSTING PLUG
SPRING
SAFETY PLUG
R.H. TIE ROD
BALL SOCKET
NUT
COVER
PIVOT ARM ASSEMBLY
L.H. SPINDLE
STEER AXLE
LOWER BEARING CONE
KING PIN
LIMIT STOP SETSCREW
THRUST BEARING
L.H. TIE ROD
SELF-ALIGNING BALL BUSHING
ROLL PIN
AXLE MOUNTING HOUSING
LOWER BEARING CUP
SPACER
R.H. SPINDLE
LOCKNUT
NEEDLE BEARING
SHIM, 22 GA.
WASHER
SNAP RING
RETAINING NUT
UPPER BEARING CUP
UPPER BEARING CONE
HT-55152

Figure 3. Steer Axle and Connections

C. INSTALLATION

1. Install self-aligning ball bushings into axle mounting housings. Screw lubrication fittings into axle mounting housings.

2. Slide axle mounting housings and spacers on each end of steer axle.

3. Install tie rods and tighten adjusting plugs. Pull adjusting plugs up tight, then loosen so there is no end play and secure in position with cotter pins.

4. Attach ball sockets in tie rods and lock in place with check nuts. Install ball sockets in spindles and secure with nuts making sure to lock nuts with cotter pins.

5. With steer axle assembly on jack, raise axle assembly into position and secure axle mounting housings to truck frame with capscrews and locknuts.

6. Install equal amount of shims between frame and spacers on each end of steer axle to eliminate all end play. Secure shims to axle mounting housings with capscrews. Torque housing mounting capscrews to 125 - 135 ft. lbs.

7. Install drag link to pivot arm. (Refer to DRAG LINK Section.)

8. Install steer wheels. (Refer to WHEEL and TIRE ASSEMBLY Section.)

D. STEERING SYSTEM ADJUSTMENT

If the steering system should require adjustment, follow the procedure outlined below:

1. Raise the rear end of the truck so that the steer wheels clear the floor. Block in position.

2. Disconnect the drag link from the pivot arm.

3. Turn the steer wheels full right and full left. Measure the distance between the wheel and the axle at both wheels. Clearance should be at least 1/2". While holding this distance, adjust the spindle stops to allow approximately .030" clearance between the stop and the spindle.

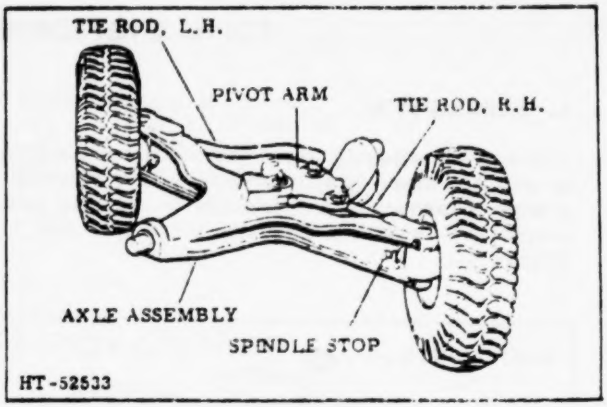


Figure 4. Stop Adjustment

4. Set the steer wheels straight ahead, parallel with the side of the truck frame. It may be necessary to adjust the tie rods to obtain this position, as zero degrees toe-in must be maintained at all times.

5. Position the plunger rod half way out of the power steering cylinder. Loosen the locknut that secures the drag link socket to the plunger rod. Turn the drag link IN or OUT while holding the power steering plunger rod with a wrench on the flats near the end of the rod. The drag link socket must be centered over the steer axle pivot arm ball stud while the steer wheels are in a straight ahead position, parallel with the frame.

6. Connect drag link to pivot arm ball stud. Tighten adjusting plug in end of drag link and install cotter pin. Then tighten locknut to secure drag link socket to plunger rod.

7. Remove the blocks and lower the rear of the lift truck so the steer wheels rest on the floor.

8. Start the engine and check the steering system. With all adjustments correctly made, the wheel spindles should contact the stop screws on the axle to prevent the piston from bottoming in the steering cylinder.

TOPIC 3. STEERING WHEEL AND COLUMN

A. DESCRIPTION

Although the steering wheel and column are similar to standard steering systems, the power steering system incorporates a hydraulically operated steer control unit instead of the usual steer gear box. (Figure 5.)

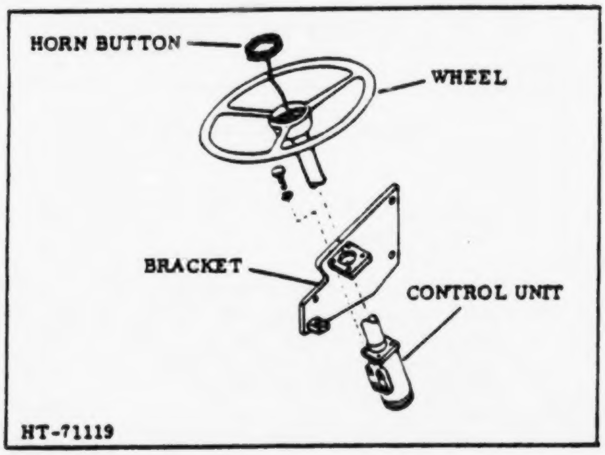


Figure 5. Power Steer Assembly

When the steering wheel is turned in either direction, hydraulic fluid is channelled through the appropriate control unit ports, thus pushing or pulling the drag link, which controls direction of wheels.

B. STEERING COLUMN ADJUSTMENT

Proper alignment of the steering column is very important. The column must not be sprung in any direction from its free position. To determine whether or not misalignment exists, release the upper column support and note whether column moves to a different position--its free position. If it does move, then it has been out of line and should be clamped in proper position, or position corrected at mounting bracket on truck. If column has been bent permanently because of severe misalignment, then replacement of the tube, shaft, or entire unit may be necessary.

C. REMOVAL

The following procedure is recommended for proper steer control unit removal:

1. Disconnect battery terminals.
2. Remove the floor and toe plates.
3. Disconnect the hydraulic lines from the steer control unit. Tag hydraulic lines for identification.

NOTE: All hydraulic lines should be plugged immediately after they are disconnected to prevent dirt from entering the system.

4. Disconnect the horn wires from column.
5. Remove the capscrews that hold the steer unit to the stationary bracket.
6. Lift the steer gear up and out of the vehicle and place in a clean working area.

NOTE: Refer to REPAIR MANUAL for DISASSEMBLY, INSPECTION, REPAIR and REASSEMBLY.

D. INSTALLATION

1. Place the steer gear control unit in its relative mounting location at end of steering column and insert and tighten securing capscrews.
2. Reconnect the horn wires.
3. Unplug and connect the hydraulic lines to steer unit as they were removed.
4. Ensure that reassembly is complete, then replace the floor and toe plates.
5. Reconnect the battery terminals.

If the steering system requires adjustment, refer to Paragraph D in preceding Topic 2.

TOPIC 4. DRAG LINK

Refer to POWER STEER CYLINDER TOPIC for REMOVAL and INSTALLATION.

TOPIC 5. TIE ROD

Refer to STEER AXLE REMOVAL to gain access to the TIE RODS, and refer to STEER AXLE DISASSEMBLY, REPAIR MANUAL, for TIE ROD REMOVAL, DISASSEMBLY, REPAIR and REASSEMBLY.

TOPIC 6. POWER STEER CYLINDER

A. DESCRIPTION

The power steer cylinder is controlled by the hydraulic steer gear unit and subsequently controls the direction of turn of the steer wheels through the drag link coupled to its output shaft.

The following procedure is recommended to remove the power steer cylinder:

B. REMOVAL

1. Raise back of vehicle with a chain hoist until cylinder connections are easily accessible. Block front wheels and place blocks under frame.
2. Place a drain pan under cylinder ports and remove hoses leading to power steer cylinder. Plug cylinder ports and cap hoses to prevent dirt from entering hydraulic system.
3. Remove drag link from pivot arm.
4. Remove cylinder from its connection at truck frame. (Figure 6.)
5. Unscrew drag link (Figure 7) from cylinder.

NOTE: Refer to REPAIR MANUAL for REPAIR procedures.

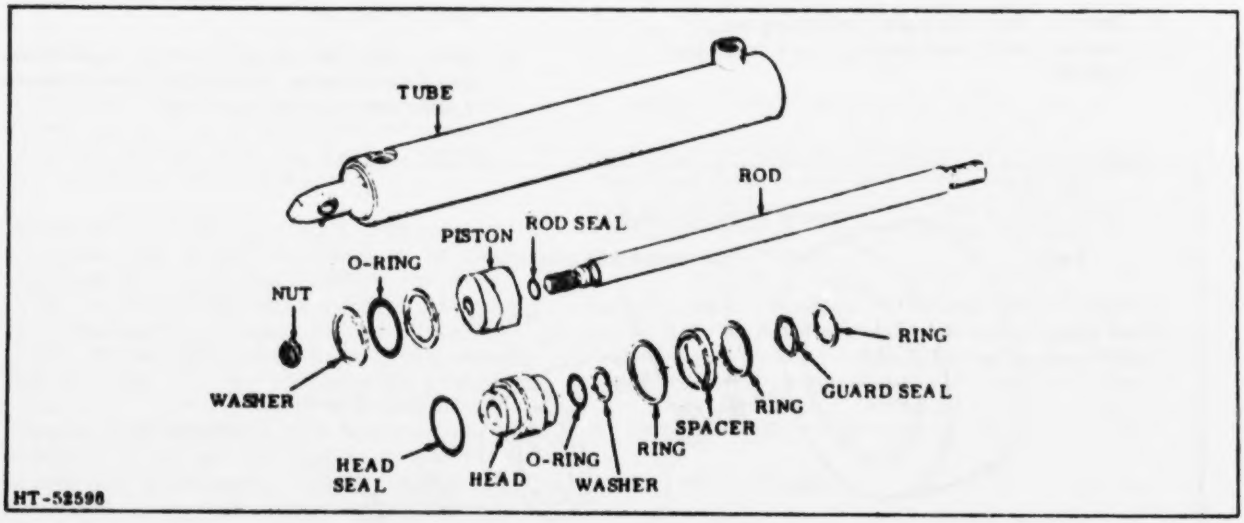


Figure 6. Power Steering Components

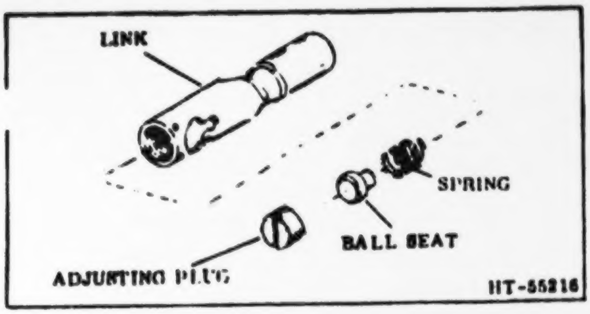


Figure 7. Drag Link Components

C. INSTALLATION

1. Attach drag link to pivot arm and to cylinder. Attach cylinder to frame.
2. Connect hydraulic lines to cylinder.
3. Loosen suction hose at hydraulic pump to make certain hose is not air-bound. With suction hose loosened, air will leak out.

> CAUTION: Make certain hydraulic oil is up to the "FULL" mark on dipstick.

4. Tighten hose and lower truck to floor.

TOPIC 7. WHEELS AND TIRES

The steer wheels are located at the rear of the lift truck, at the counterweight end. To remove either or both steer wheels, it is recommended that the drive wheels be properly blocked and that a properly attached hoist chain and jacks or blocks be used to raise rear of truck for steer wheel tire removal.

C. REMOVAL (CUSHION TIRE TYPE)

1. Attach a suitable hoist to the rear of the truck and lift the truck until the steer wheels clear the floor.
2. Remove the capscrews and lockwashers that secure the hub cap to the wheel and remove the hub cap.
3. Remove the cotter pin, retaining nut, washer, and outer bearing cone from the spindle.
4. Carefully remove steer wheel from spindle.

D. INSTALLATION (CUSHION TIRE TYPE)

1. Lubricate the bearing cups in the wheel and carefully install the wheel on the spindle.
2. Lubricate the outer bearing cone with the specified lubricant, using an applicator. Install the bearing cone on the spindle.
3. Install washer and retaining nut. While rotating wheel, tighten the retaining nut to 50 ft. lbs. Back off nut until it is loose (0 ft. lb). Rotate the wheel in both directions and tighten the nut to 25 ft. lbs. Back the nut off 30° minimum to 60° maximum, and install cotter pin.
4. Install hub cap and secure with capscrews and lockwashers; tighten capscrews securely. Lower the truck to the floor.

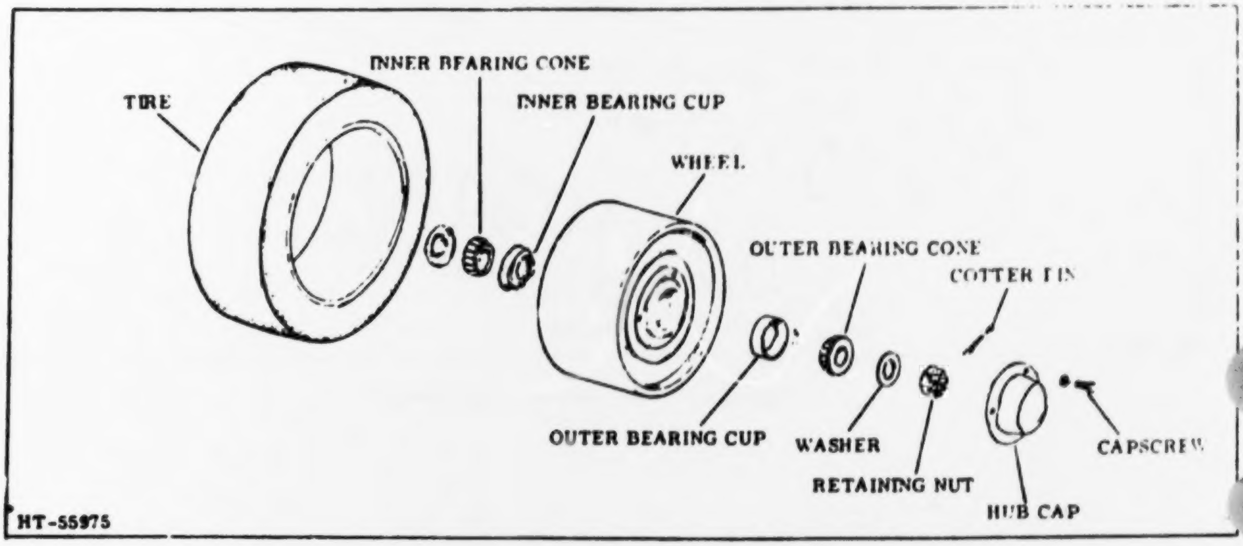


Figure 9. Steer Wheel Assembly - (Typical)
(Cushion Tire Type)

TOPIC 1. HYDRAULIC SYSTEM SERVICE

A. GENERAL

The hydraulic system provides the means by which the lift, tilt, and accessory operations are controlled. Included in the system is an engine driven, gear type pump that supplies hydraulic oil to the control valve. From the control valve, the flow of hydraulic oil under pressure is directed to the appropriate cylinders. The hydraulic oil is cleaned by a filter located between the control valve and reservoir. The reservoir provides an adequate supply of hydraulic oil to the pump plus an ample reserve. A suction port is provided at the bottom of the reservoir to gravity feed oil to the hydraulic pump.

B. GENERAL MAINTENANCE

It is essential that personnel responsible for the care of the unit adhere to the following general maintenance recommendations:

1. Store and handle hydraulic oil with utmost care to prevent moisture and foreign matter from entering the hydraulic system. All hydraulic oil handling equipment, such as a container, funnel and hand pump, should be kept clean at all times and covered when not in use.
2. Keep all fittings and connections tight to eliminate oil leaks. However, do not tighten any fittings excessively because damage or distortion will result.
3. Before a component is removed from the hydraulic system, be sure to wash the component and its surrounding area with cleaning solvent to prevent entrance of foreign matter into the system. Cover all openings immediately.
4. Whenever a fitting with a pipe thread is removed, use a sealing compound on the outside of the threads before the fitting is installed. Make certain all parts are thoroughly cleaned before installation. Do not put sealant on first thread of fittings, it may contaminate system.
5. When a hose assembly is installed, make certain it is not twisted when the fittings are tightened. Always use two wrenches on swivel type fittings, one to hold the hose and the other to tighten the fitting.
6. Keep hose clamps tight to prevent hose from chafing and to avert leakage.
7. Oil leaks at the lift and tilt cylinders should be corrected as soon as leakage becomes evident.

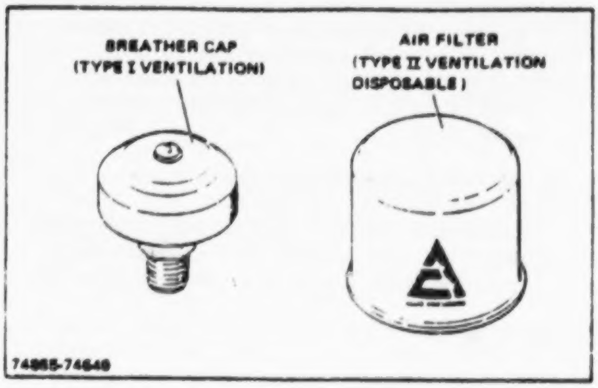


Figure 1-1. Reservoir Ventilation

8. Periodically check the pump and control valve mounting hardware for tightness.
9. Replace filter element and clean the (Fig 1-1) reservoir breather cap, and hydraulic oil reservoir at the recommended service intervals.

CAUTION: Keep the hydraulic system clean. A contaminated hydraulic system is the major cause of hydraulic pump, control valve, and packing wear or failure. It is therefore advised that any oil that is added or replaced be filtered through a 10 micron filter, or finer, before entering the hydraulic system.

C. DAILY INSPECTION

Daily during operation, occasionally inspect the floor area where the lift truck was operating to check for oil leaks from the hydraulic system. Correct leaks as soon as they become evident.

Daily, check reservoir oil level. Oil should be up to the full mark on dip-stick when mast is lowered and all cylinders are retracted. Add specified oil if necessary.

D. 50 HOUR INSPECTION

1. Lift Cylinders

   After each 50 hours of operation, inspect the mast lift cylinder(s) for leaks; correct any that are evident. Check lift cylinder hoses and fittings for leaks; correct if necessary.

   No adjustment can be made on the mast lift cylinders. When leakage occurs, the seals must be replaced.

2. Tilt Cylinders.

After each 50 hours of operation, check cylinder hoses and fittings for leaks; correct if necessary. Check cylinder mountings and make certain yoke is tight on plunger so plunger does not rotate in cylinder. Also lubricate yoke pins.

3. Filter Element Replacement

After the initial 50 hours of operation the filter element (Fig 1-2) must be replaced and the filter housing flushed.

E. 200 HOUR SERVICE

1. Filter Element Replacement

A filter is installed in the hydraulic system between control valve and oil reservoir to provide complete filtering of the hydraulic oil. This filter is a bypass type and therefore contains a bypass valve which permits oil to bypass a clogged element and flow directly to the reservoir. The element is the paper type and cannot be cleaned; it must be replaced.

After each operating interval of 200 hours, replace element (Fig 1-2) as follows:

a. Filter housing has a large hexagon head cast at the base of the housing. Use an appropriate wrench to loosen and remove filter housing and element. Type II filters require removal of four attaching capscrews.

NOTE: O Ring will come out with housing as it is seated in a groove in the upper end of the housing.

b. Remove O Ring from housing and discard it.

c. Discard old filter element. Thoroughly clean inside of filter head and housing; inspect for any defects. Replace damaged parts if necessary.

d. Place a light coat of clean hydraulic oil on new O Ring and carefully install O Ring in groove in upper end of housing. Be careful not to overstretch or tear O Ring.

e. Insert new element into housing and install housing into filter head. Hand tighten and make certain element center hole aligns properly within filter head.

f. Use a wrench and tighten housing to

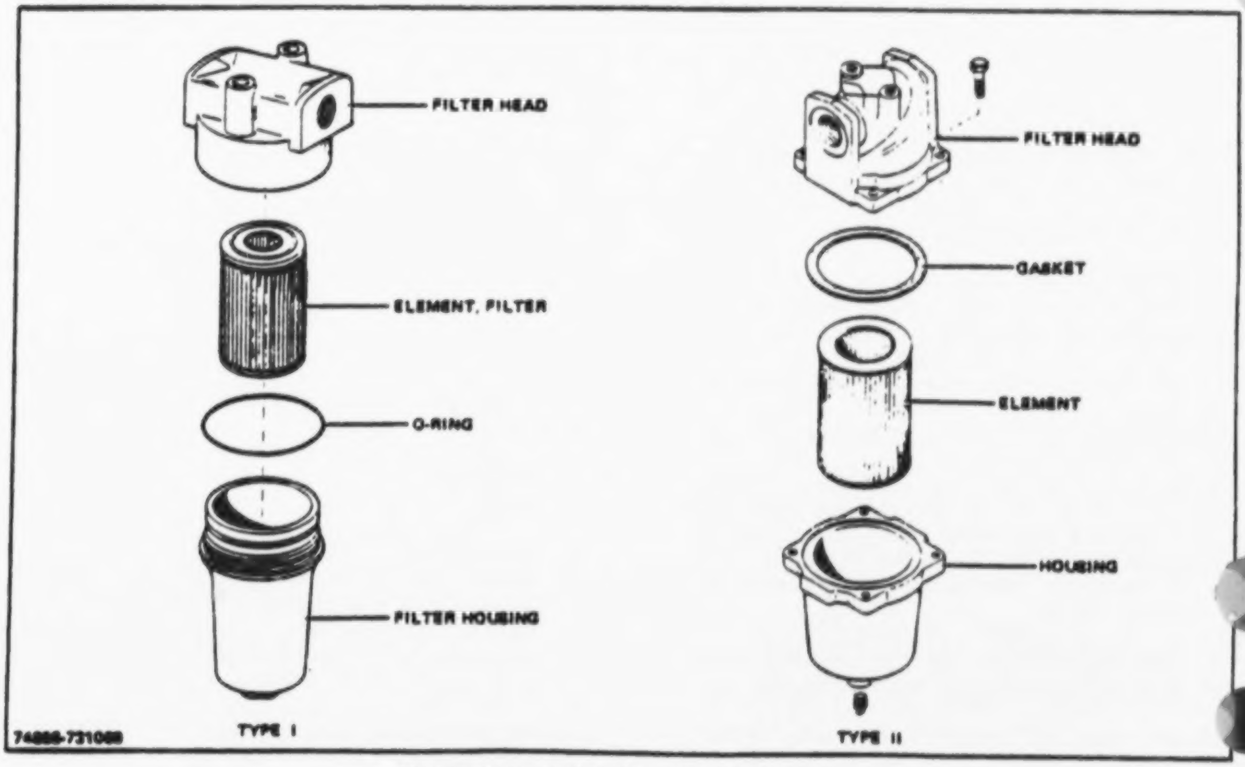


Figure 1-2. Hydraulic Oil Filters

20-30 lb-ft max. for Type I filters. Capscrews on Type II should be tightened to 30-35 lb-ft.

g. Operate hydraulic system and check for leaks. Correct if necessary.

h. Check hydraulic oil reservoir level with all cylinders retracted. Fill reservoir with specified oil to full level if necessary.

2. Hydraulic Oil Reservoir

After initial 200 hours of operation of new truck drain and flush reservoir.

3. Breather Cap (Type I Ventilation)

After each operating interval of 200 hours, breather elements must be cleaned. Remove and clean elements as follows:

a. Remove breather cap (Fig 1-1) from the hydraulic oil reservoir.

b. Remove locknut, washer, and element.

c. Clean element in a suitable cleaning solvent and dry it with compressed air.

d. Dip element in SAE 10 or 20 engine oil; allow oil to drain before element is installed.

e. Install element, washer, and locknut. Tighten locknut securely.

f. Install breather cap securely in the hydraulic oil reservoir.

4. Air Filter (Type II Ventilation)

After each 200 hours operation unscrew filter and replace with a new one.

F. 500 HOUR INSPECTION

After each operating interval of 500 hours, inspect all hoses and fittings used in the hydraulic system. Replace hoses that are damaged or deteriorated. Check for leaks and correct any that are evident.

The control valve requires very little attention with the exception of keeping the lines, fittings, hose connections and mounting hardware tight. Also after every 500 hours of operation, check the control valve linkage.

G. 1000 HOUR SERVICE

Hydraulic Oil Reservoir

The hydraulic oil reservoir is located within the right side of the truck frame. Installed in the top of the reservoir is an easily accessible breather and an oil level dipstick to allow for a quick check of the reservoir oil level. To avoid aeration of the hydraulic fluid the oil level must be maintained at the proper level. Air enters or exits through the breathers to compensate for changes of the oil level in the reservoir during operation of the hydraulic system.

After each operating interval of 1000 hours, oil in reservoir should be drained. This is important primarily because of condensation and contamination. Heating of oil during operation and cooling of it when lift truck is not in use contributes to condensation which is detrimental to the hydraulic system. Contaminants such as dirt, rust, scale, and products of oil deterioration are also detrimental. Drain and clean oil reservoir as follows:

1. Lower mast so lift cylinder is at its fully lowered position and all cylinders are retracted.

2. Remove drain plug from bottom of oil reservoir and allow oil to drain into a container.

CAUTION: Do not operate hydraulic pump to drain hydraulic system.

3. After oil has drained flush inside of reservoir with a suitable cleaning solvent. Reservoir cover plate must be removed for flushing process. Reservoir may be removed from truck if so desired.

4. Dry inside of reservoir with clean, dry compressed air.

5. Install drain plug in reservoir. Fill reservoir with clean specified hydraulic oil. During filling operation, make certain a clean container or funnel is used and mast is lowered and all cylinders are retracted.

6. Install breather. Operate hydraulic system and check for leaks; correct any if necessary.

H. HYDRAULIC PUMP

The hydraulic pump is a tandem type dual gear unit driven by the engine. The pump has a common suction port and one or two discharge ports. The internal parts of the pump are machined to a high degree of accuracy and the tolerances are very close. If a pump is in need of repair which requires complete disassembly, it is recommended the pump be sent to your local Allis-Chalmers lift truck dealer for repair.

Include your purchase order and full information regarding the nature of the breakdown.

In some cases where a pump is inoperative, it may be possible to repair it in the field. Satisfactory repair can be accomplished, provided a clean, well equipped repair shop manned by a competent mechanic is available.

I. CONTROL VALVE

The function of the control valve is to direct the flow of the hydraulic oil, under pressure, to the appropriate cylinders. The control valve requires very little attention with the exception of keeping the hydraulic lines and hose connections tight.

There are normally, two operating plungers in the valve. One is a single acting plunger which operates the lift cylinder. The other is a double acting plunger to operate the tilt cylinders.

When the control lever is in "neutral" position, the oil is being circulated through the open center of the valve and back to the reservoir; but is not entering any of the cylinder ports. As the control lever is moved to its operating position, the cylinder ports begin to open and the open center passage begins closing. At the extreme limit of control lever travel, the cylinder ports are open and the open center passage is closed. The applied oil pressure then opens the check valve and allows the oil to flow to and/or from the lift or tilt cylinders.

An adjustable relief valve is incorporated in the control valve. It is used to relieve extreme pressures when maximum tilt or lift position, or overloads are reached, to prevent damage to the hydraulic system.

1. Linkage

Improperly adjusted or out of adjustment linkage can result in binding or bending of the control valve linkage.

Ensure that tilt and lift control levers and associated linkage travels freely and smoothly through forward and backward movement of each lever and that the control valve plungers respond accordingly. Adjust, repair or replace as is necessary.

Be certain that pivot points or other mating surfaces are free of accumulated sludge and remain lightly lubricated to function smoothly.

J. CHECKING CONTROL VALVE INLET PRESSURES

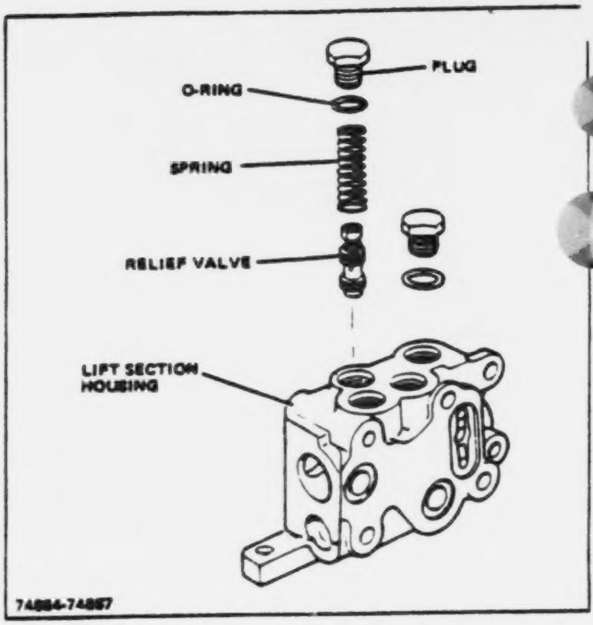


Figure 1-4. Relief Valve

1. Relief Valve Adjustment

Whenever the control valve or hydraulic pump has been repaired or replaced, check the relief valve and adjust to open at specified pressure. Check and adjust th relief valve (Fig 1-4) located in the li section of the control valve as follows:

a. Gain access to the control valve; actual location varies between truck models.

b. Some adapters have a plug in them where a pressure gauge can be installed. If unit is not equipped with this type adapter. Disconnect the hydraulic line at the inlet port of the control valve.

c. Install a tee fitting on the end of the hydraulic line and connect the tee fittings to the adapter in the inlet port.

d. Install a pressure gauge with a 0 to 3000 psi range in the tee.

e. Place shift lever in neutral position, turn key switch ON and start engine.

f. Pull the tilt lever back to retract the tilt cylinders and hold lever i this position.

g. While holding lever, observe the needle on the pressure gauge. When pressure reading of 1950 psi is attained, the needle will stop, indicating relief valve opening.

h. If the relief valve opens below or above 1950 ± 50 psi, it must be adjusted as follows:

(1) Turn key switch OFF.

(2) When pressure gauge reads zero remove relief valve plug.

(3) Check relief valve assembly and valve spring for damage. Replace defective parts.

(4) Install valve assembly with spring, O-ring, and plug.

(5) Repeat steps e through g.

i. Turn key switch OFF.

j. Remove pressure gauge and tee; then install hydraulic line to control valve fittings.

LIFT CYLINDER

1. General

As previously stated, the lift cylinder receives hydraluic oil under pressure from the control valve to raise the lift cylinder plunger or plungers, depending upon the type of mast assembly. The hydraulic oil is applied at the base of the lift cylinder or near the center or the cylinder and compels the plunger(s) to extend.

A flow regulator, which is located at the base of the lift cylinder, controls the flow of hydraulic oil so the load lowers at a controlled rate of speed from the raised position.

L. TILT CYLINDERS

1. General

The tilt cylinders (Fig 1-8) are used to tilt the mast assembly forward or backward. The cylinders, when activated by the control valve, receive oil under pressure in either forward or rear ports. As an example, the hydraulic oil enters the forward ports and forces the plungers backward. At this same moment, hydraulic oil is forced out of the rear ports of the cylinders by the plunger pistons and is returned to the reservoir through the control valve. When the hydraulic oil is directed to the rear ports of the cylinders, the opposite will occur.

2. Inspection

a. Oil Leakage - Gland Nut

Check for oil leakage at the gland nut. Oil leakage at the gland nut indicates seals are worn; to stop leakage, remove gland nut with a spanner wrench and replace seals.

CAUTION: In the following checks DO NOT operate the control lever in the direction opposite to that specified in the procedure.

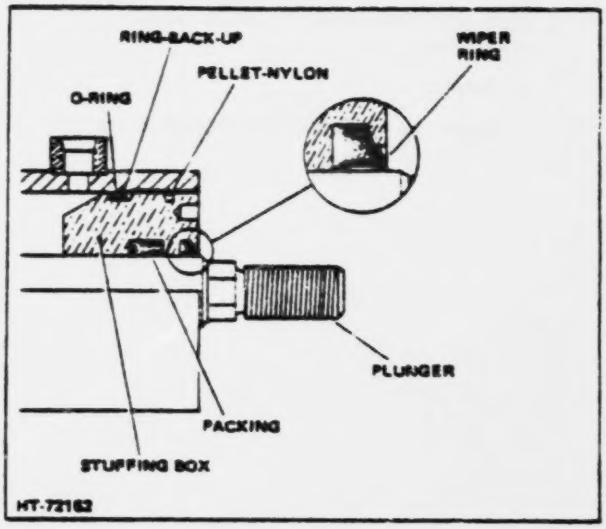


Figure 1-8. Tilt Cylinder

b. Oil Leakage - Piston Seal

If mast assembly tilts too slowly or creeps under load, it is an indication that oil is leaking past piston seal in tilt cylinders. This can be checked as follows:

(1) Tilt mast assembly forward to its extreme limit.

(2) Loosen hose fittings at front port end of tilt cylinder.

(3) With battery connected and engine running place and hold tilt control lever in forward position; check for oil flow through the front fittings of cylinders. If oil flows out of the opening of cylinder, remove cylinder and replace piston seal.

(4) To check piston seal when mast assembly is at its extreme backward position, reverse the procedure in preceding Steps (1) thru (3).

M. STEERING

For POWER STEERING or POWER ASSISTED STEERING components maintenance refer to appropriate MAINTENANCE MANUAL MODULE.

N. SIDE SHIFT AND GUARD CYLINDERS (when applicable)

1. Service

Check the cylinder mountings when the truck is lubricated. Check stroke of two overhead guard cylinder plungers to make sure they are even. Uneven stroke can cause serious damage to cylinders, guard structure, and frame. Check for any oil leakage at the cylinder head and hose connections.

2. Oil Seepage - Cylinder Head

Oil seepage indicates the packing is worn and must be replaced. Check the plunger for scratches or score marks before installing new packing. Refer to Chapter II - OVERHAUL.

3. Oil Seepage - Piston Packing

If operation of side shift or guard is slow or sluggish, the oil could be leaking past the piston seal ring or packing cup. Check as follows:

a. Extend cylinder to maximum limit.

b. Disconnect hoses at front end of both cylinders.

c. Hold control handle in fully extended position. Accelerate engine and check for oil flow through front port. If oil flows from port, remove cylinder and replace packing.

d. Reverse operation to check cup packing.

COUNTERWEIGHT AND FRAME

TOPIC 1. COUNTERWEIGHT AND FRAME

A. DESCRIPTION

e lift truck frame design reflects the atest advancement in stress analysis engineering. This produces a lighter, stronger and less bulky unit. The major components of the frame consist of the base welded frame assembly, the counterweight, rear grille, engine hood and side panels, seat support assembly and seat, the floor and toe plate, and the overhead guard assembly. All of the above component parts are easily removed to facilitate quick repairs and easy accessibility during the maintenance routine.

TOPIC 2. COUNTERWEIGHT

A. GENERAL

Excepting the variable weight difference and subtle exterior design contours, there are two basic types of counterweight; one, the prevalent style which incorporates three or more mounting bolts, and the counterweight which incorporates only one attaching bolt (Fig. 2).

Certain care must be exercised during the removal and installation of the counterweights to prevent equipment damage or bodily injury.

B. 200 HOUR INSPECTION

After each 200 hour interval of operation, check counterweight mounting bolts for tightness. Make certain that tow stud or counterweight mounting bolts are tightened securely.

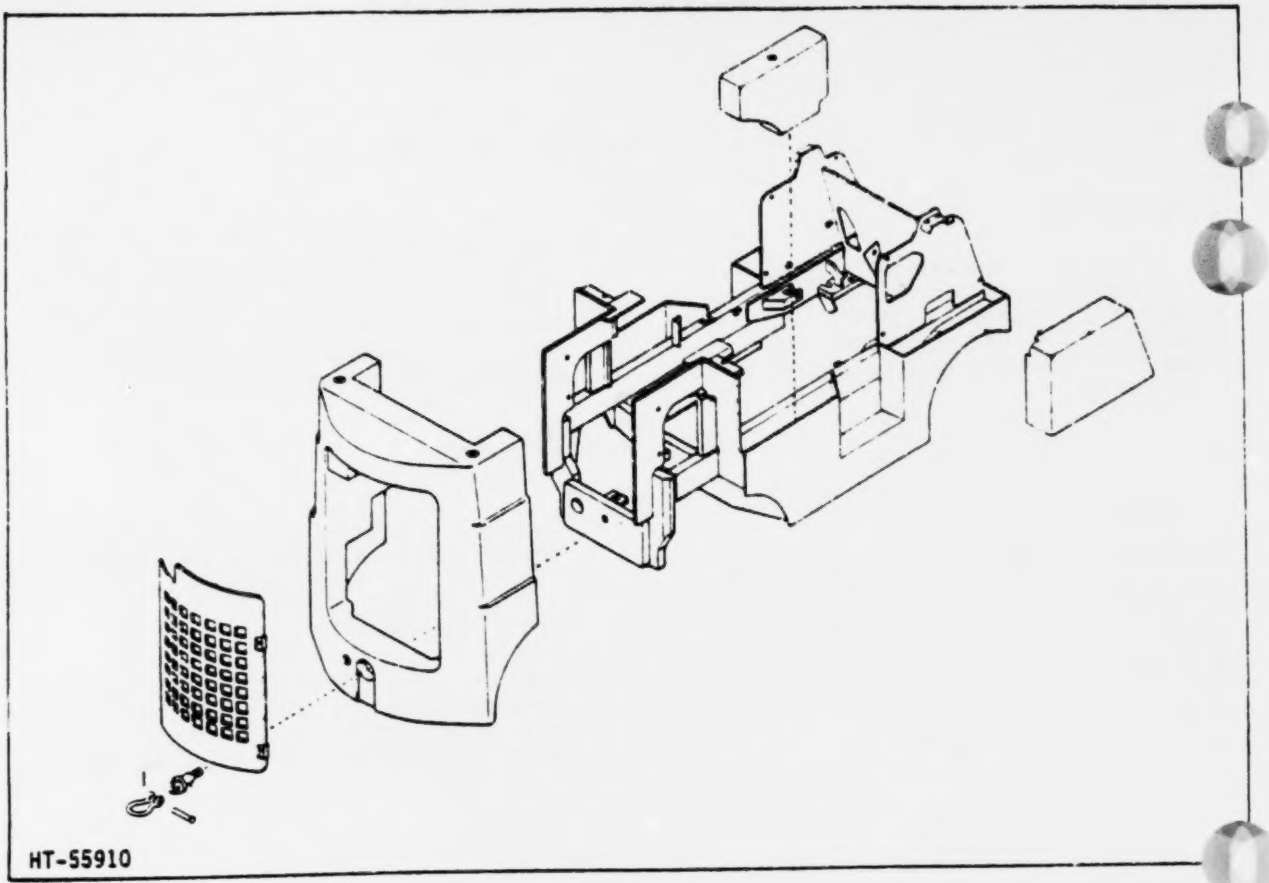


Figure 2. Counterweight and Frame (Typical)(Cushion Lift Truck)

NOTE: On Models ACP 100-120-140, the counterweight is utilized as a part or extension of the frame. Because of this the torque of the counterweight mounting bolts is important. Specified torque for the ACP 100-120-140 counterweight mounting bolts is 600 lb-ft.

C. REMOVAL

1. Ensure that lift truck is properly located under hoist chain for removal, and that truck is adequately blocked to prevent rolling.
2. Attach hoist chains to counterweight (eyelets, where applicable) and take up slack in chain.

WARNING: Be certain that hoist chain and lift are adequately rated for estimated counterweight mass density. Do not attempt to lift counterweight with a hoist rated below estimated counterweight mass.

3. If applicable, remove the grille assembly mounting capscrews and lockwashers while supporting grille.
4. Remove grille and rear panel, if installed.
5. Using the hoisting chain to relieve the pressure, remove mounting bolts (bolt), nuts (if so equipped), and washers.
6. Ensure that counterweight is free of attachment to truck frame, then very carefully lift counterweight up slightly and then out away from frame.

CAUTION: Be certain that counterweight clears hydraulic pump during removal. Failure to use care will result in unnecessary destruction of equipment.

7. Ensure that counterweight is properly balanced and blocked, if necessary, prior to disengaging hoist chains.

D. INSPECTION

Carefully inspect counterweight for fractures,

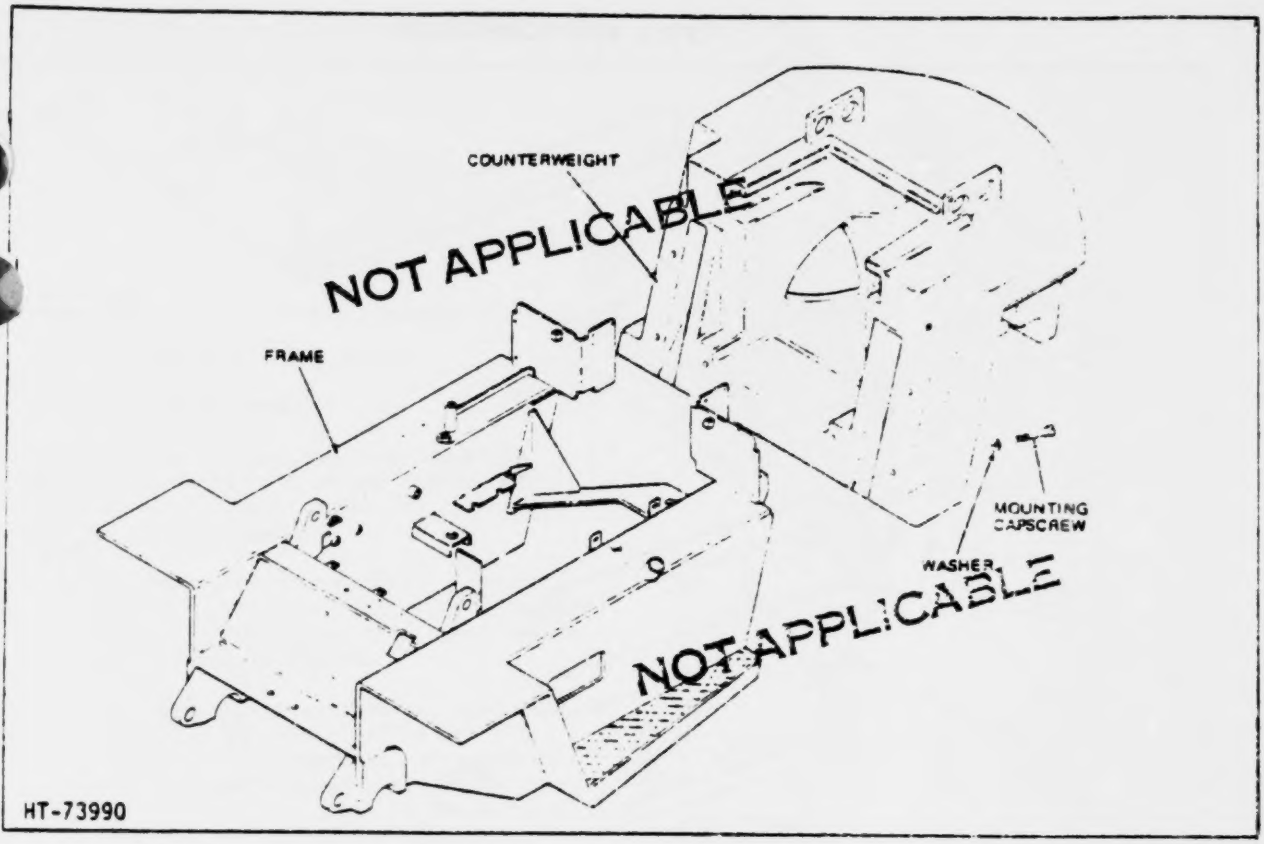


Figure 3. Counterweight and Frame (ACP 100-120-140)

particularly at mounting points, such as the bolt hole, and at right angle stress points.

It is common practice to replace, rather than attempt to repair a badly fractured counterweight. But when the truck is operated within reasonable stress limits and not abused, such damage is highly unlikely.

E. INSTALLATION

1. Ensure that rear of lift truck (counterweight mounting area) is clear of any obstructions prior to installation.

WARNING: Be certain that hoist chain and lift are adequately rated for estimated counterweight mass density. Do not attempt to remove or install a counterweight with a hoist rated below estimated counterweight mass.

2. Securely attach hoisting chains to counterweight (eyelets, where applicable), then lift and maneuver counterweight into its relative mounting position on the lift truck frame.

CAUTION: Be certain that counterweight clears hydraulic pump during installation. Failure to use care will result in unnecessary destruction of equipment.

3. Carefully lower counterweight into mounting surfaces and keep enough tension in hoist to allow insertion and tightening of securing bolts. (bolt), lockwashers and nuts (nut). Refer to NOTE in preceding Paragraph 8, 200 HOUR INSPECTION.)

4. Replace grille and rear panel, if applicable, and insert and tighten capscrews and lockwashers.

5. Ensure counterweight is properly secured and that hydraulic pump is intact.

6. Slowly play out hoist chain until there is enough slack to disengage chain hooks. Remove hoist chains.

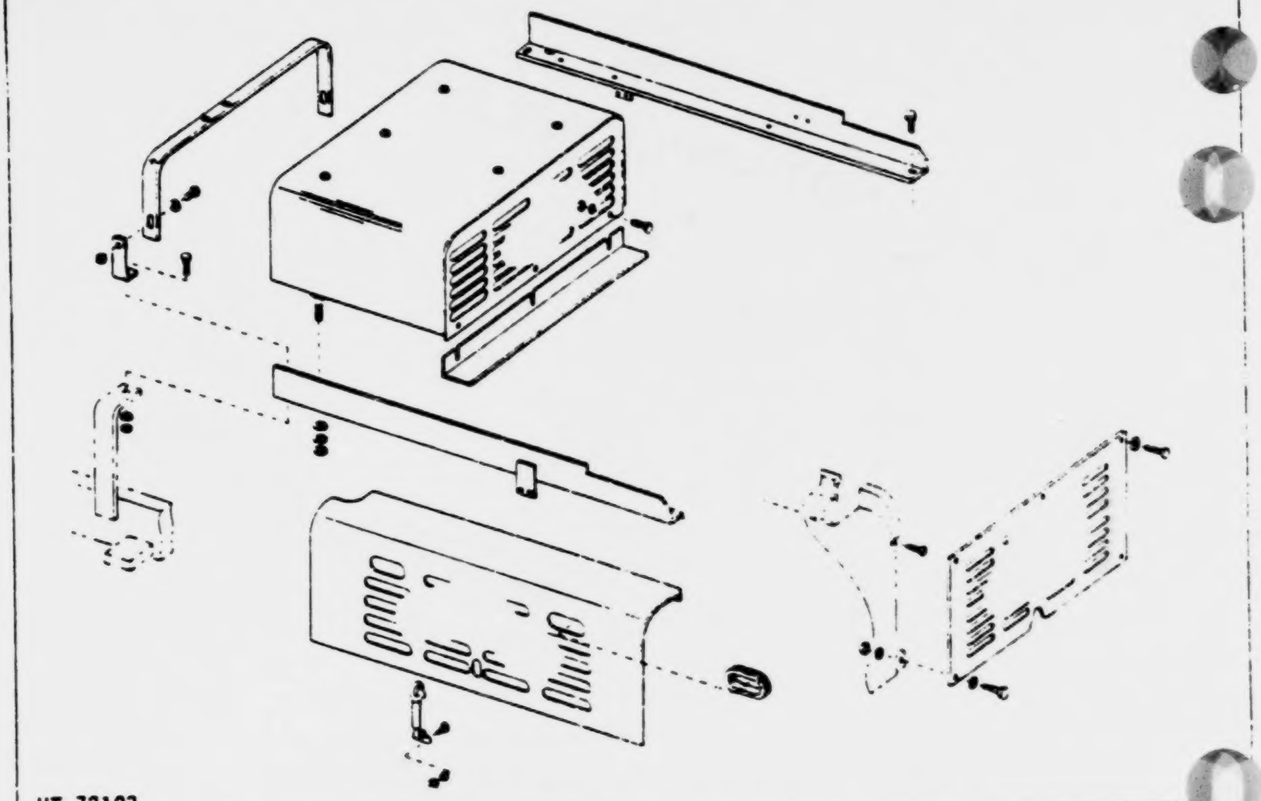


Figure 4. Engine Hood, Side Panels and Grille (Typical)
(Pneumatic Lift Truck)

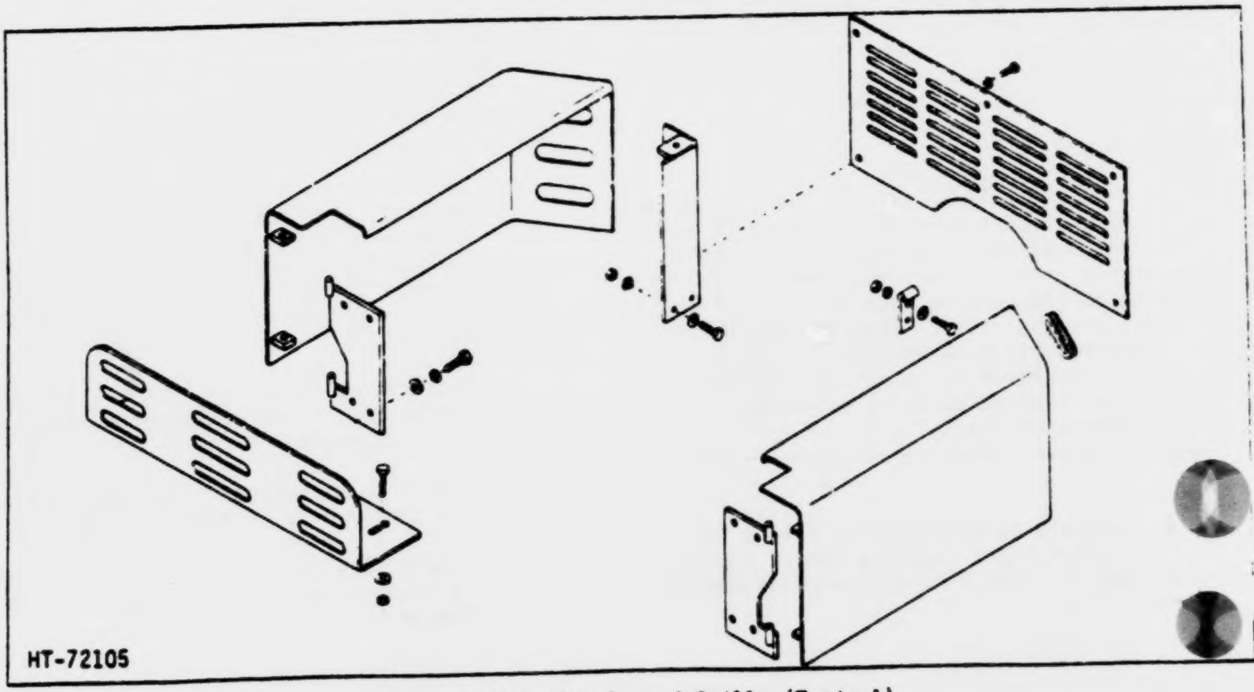


Figure 5. Side Panels and Grille (Typical)
(Cushion Lift Truck)

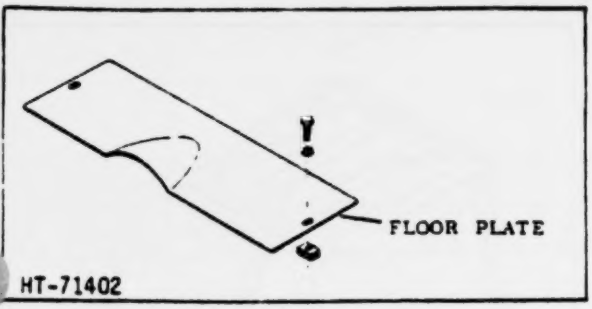


Figure 6. Floor Plate

A. HOOD AND SIDE PANELS

Figures 4 and 5 represent a non-specific, general representation of the engine hood, side panels and front engine grille typical to all lift truck models.

1. The side panels are normally secured with a spring type latch, the disengagement of which allows side panel removal for service to engine.

2. The hood, cross assemblies, seat support assembly, and front grille are all attached with capscrews, lockwashers and nuts. To disassemble, simply study the inter-relationship of the parts of interest and remove the capscrews, lockwashers, nuts and parts required for access to component requiring service.

3. Reverse disassembly procedure, as required, to reassemble.

B. FLOOR AND TOE PLATE

Refer to Figures 6 and 7 to locate the floor and toe plates. As a rule the floor and toe plates will require no maintenance whatever, but are removed during normal maintenance routine to service items such as transmission, steering column, brake master cylinder, etc.

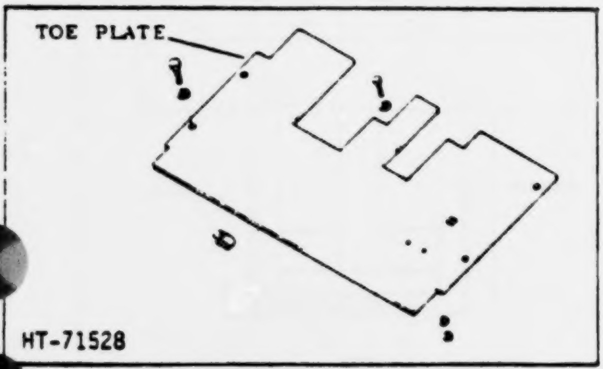


Figure 7. Toe Plate

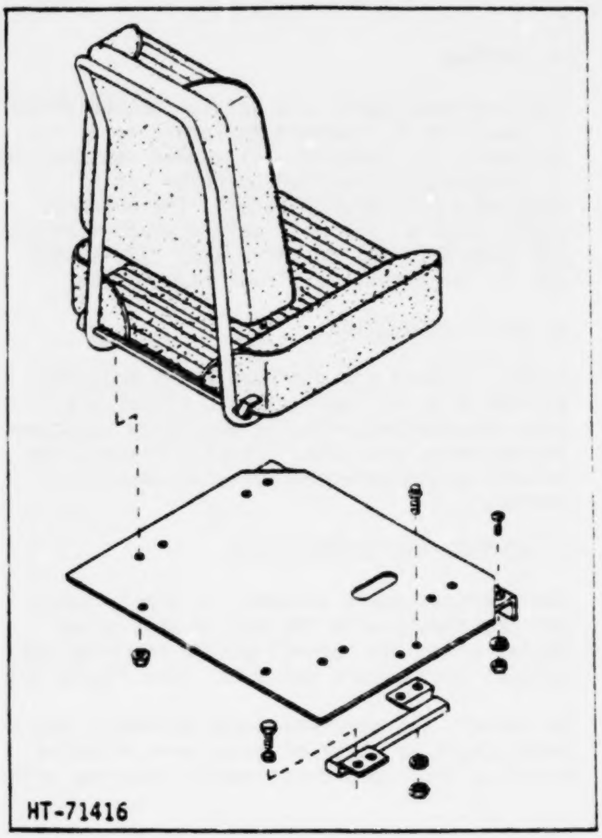


Figure 8. Seat Assembly

1. To remove floor and/or toe plate, simply remove capscrews and lockwashers and lift plate away from truck.

2. To install either or both plates, place in correct position, align holes and replace capscrews and lockwashers.

C. SEAT ASSEMBLY

The operator's seat has two vinyl covered, foam rubber cushions; one serves as a backrest and the other as the seat cushion. These cushions are contoured for maximum comfort and reduced sliding.

The seat assembly (Fig. 8) has a forward/backward adjustment to allow for optimum pedal reach as desired by operator.

1. Should it become necessary to remove the operator's seat, simply remove the seat base assembly mounting capscrews and lift from truck.

2. To replace the operator's seat, place assembly in relative mounting position, align all holes and insert and secure capscrews and lockwashers.

TOPIC 4. OVERHEAD GUARD

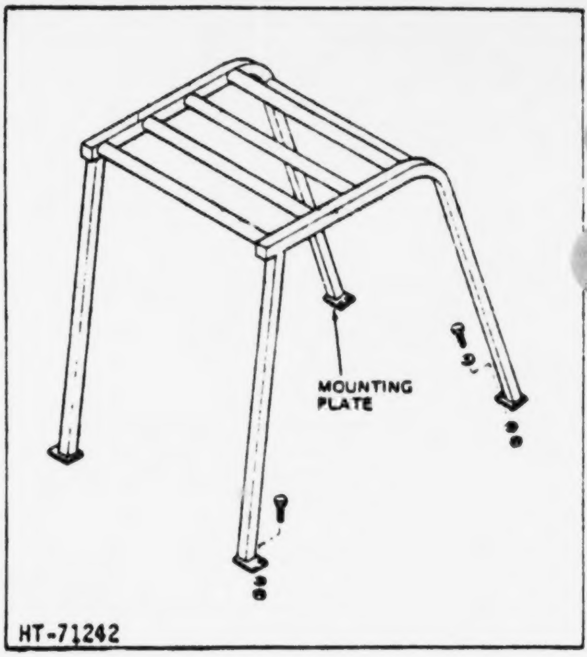


Figure 9. Overhead Guard Assembly (Typical)

A. GENERAL

The overhead guard is a safety feature which is supplied as standard equipment by Allis-Chalmers. Its tubular, all welded construction is designed for maximum operator visibility coupled with operator safety. The overhead guard complies with all safety specifications and standards set forth in ANSI B56. 1-1969 and by the Industrial Truck Association.

B. DAILY INSPECTION

Daily, inspect the overhead guard mounting plates (Fig. 9); make certain plates are securely mounted with the necessary capscrews, lockwashers, and nuts. Visually inspect the welded joints and structure for possible cracks.

C. REMOVAL AND INSTALLATION

The overhead guard assembly is simply taken off the truck, with the assist of a hoist chain, after the removal of the securing capscrews, lockwashers and nuts. (See Figure 9.)

To install the overhead guard assembly, use hoist chain to position guard over relative mounting location, then insert capscrews with lockwashers and nuts, and tighten evenly and securely.

TOPIC 1. GENERAL DESCRIPTION

The High Free Lift mast assembly includes of the following: parallel welded, telescoping uprights (channels or beams) actuated by hydraulically controlled lift cylinder(s), a carriage assembly, and adjustable lift forks.

Several mast assembly configurations are available, depending on the ultimate application of the lift truck. These masts are of the welded type construction and offer the operator a wide visibility range. The masts use shimmed canted roller bearings or wear plates and shims.

The canted roller type construction (Fig 1-1) utilizes ball bearings to provide friction free operation within the telescoping upright sections.

The wear plate type mast (Fig 1-2) utilizes wear plates which are installed at the top and bottom of the mast assembly. These keep the inner channel section centered within the outer section.

The fork and carriage assembly and the telescoping mast upright section is controlled by independent rollerless type lift chains. The chains travel over anti-friction bearing guides for safety as well as functional assistance. Each chain has sufficient strength to safely handle the recommended load capacity.

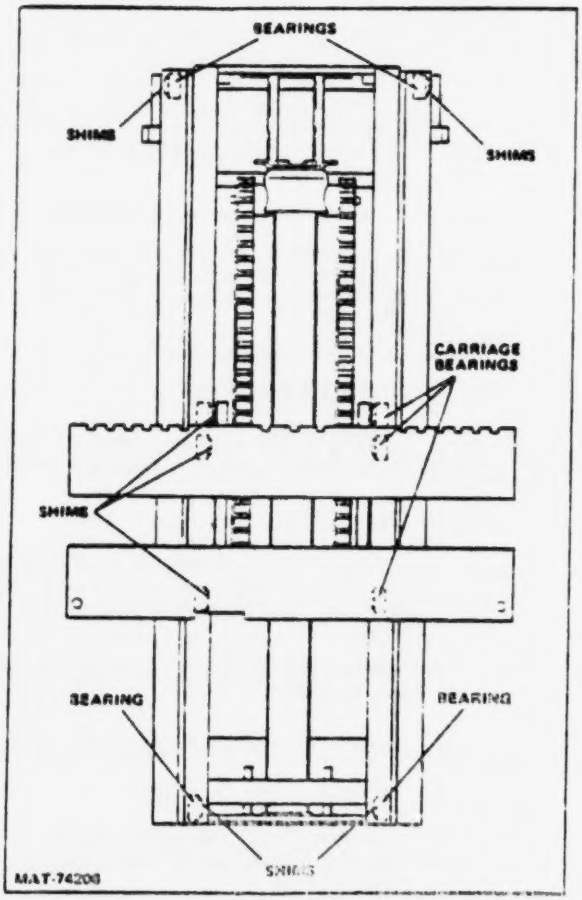


Figure 1-1. Canted Roller Type Carriage and Mast (Typical)

TOPIC 2. MAST ASSEMBLY

A. GENERAL

The conversion of the hydraulic system fluid energy into mechanical energy necessary in lift truck operation is accomplished by the mast assembly. The high free lift mast is constructed of two structural uprights. All high free lift masts utilize two (2) lift chains for safety and to minimize the effect of off center loading. The chain anchors are individually adjustable to ensure equal tension and a level fork carriage. The chains are centrally located so as to offset any bending action on the lift cylinder plunger(s).

Should it become necessary to re-center the mast uprights for smooth and even operation, the following alignment procedures are provided (adjustment method varies with the model and load capacity of mast employed): canted bearing type; wear plates and aligning shims; and roller bearings and aligning shims. Each of these methods of adjustment is detailed in the following Paragraph F, ADJUSTMENTS.

B. MAINTENANCE LUBRICATION

1. 50 Hour Service

   After every 50 hours of operation, all inner and outer web surfaces of the mast uprights should be lubricated. To perform this requirement, fully extend the mast; coat all inner and outer web surfaces of the mast uprights with a moderate amount of high quality Grade 2 wheel bearing grease or Grade 2 lithium base grease (characterized by the word "Moly"). Also lubricate all grease fittings.

2. 100 Hour Service

   Lubricate interlock spacer and screw, located on inner section of cluster type or primary and secondary type cylinder mast. Use SAE 10 or 20 engine oil.

NOTE: The bearings used on the canted bearing type mast are the prelubricated type and do not require periodic lubrication. However, with this type of mast construction, the camber or roller side of the bearing is designed to thrust against the face of the mast uprights.

C. REMOVAL

CAUTION: Fully retract or lower lift cylinders.

1. Remove the carriage. (Refer to CARRIAGE MAINTENANCE MANUAL.)
2. With the mast fully lowered, attach a sling from an overhead hoist to the mast lift eyes to secure entire mast assembly during removal.

CAUTION: Be certain overhead hoist is rated to safely support mast assembly weight.

3. Disconnect tilt cylinders from outer mast.
4. Disconnect hydraulic hoses from lift cylinders.

NOTE: Cap or plug hydraulic hoses and inlet and outlet ports on lift and tilt cylinders to prevent contamination by foreign particles.

5. (PIVOT PIN TYPE) Remove lockwires, capscrews, and lockwashers which retain pivot pins to mast assembly. Raise overhead hoist high enough to relieve pressure on the pins and remove them. Use hoist to lay mast on suitable supports.

NOTE: Adjustment of canted bearing type mast must be made before reassembly of mast. (Refer to following Paragraph F, ADJUSTMENTS.)

D. DISASSEMBLY-INSPECTION

Refer to REPAIR MANUAL for proper DISASSEMBLY, INSPECTION, REPAIR and REASSEMBLY procedures.

E. INSTALLATION

1. Use a properly rated hoist and maneuver the mast assembly into its relative mounting position on front of lift truck.
2. Connect and properly secure the tilt cylinders.
3. Reinstall hydraulic hoses.
4. Reinstall the carriage.
5. Lubricate mast uprights (Refer to preceeding Paragraph B, MAINTENANCE LUBRICATION.)

TOPIC 3. LIFT CYLINDERS

A. GENERAL

The hydraulic oil enters the lift cylinder at or near the base of the cylinder causing the plunger to extend.

A flow regulator, located at the oil inlet port of the lift cylinder, controls the outflow of hydraulic oil so that the load lowers at a controlled rate of speed from the raised position.

B. MAINTENANCE

1. 50 Hour Inspection

   After each 50 hours of operation, inspect the mast lift cylinder, cylinder hoses, and fittings for evidence of leaks and repair as necessary.

2. 100 Hour Inspection

   After each 100 hours of operation, wipe oil and foreign matter from lift chains and inspect them for bent or cracked links. Use a 1" paint brush and lubricate both sides of chains with SAE 20 engine oil. Wipe off excess oil with a clean rag. If chains are loose or carriage is not level, the chains must be adjusted. (Refer to following Paragraph E, LIFT CHAIN ADJUSTMENT.)

3. 500 Hour Inspection

   Approximately every 500 hours of operation, remove the lift chains from mast assembly and clean them in an oil solvent solution (50% SAE-30 nondetergent engine oil and 50% suitable cleaning solvent). Soak chains in oil-solvent solution for about four (4) hours and agitate them several times during the soaking period. Remove chains from oil-solvent and wipe off all of the cleaning solution. Inspect lift chains for wear and broken or cracked links. Replace entire chain if any links are broken or cracked. Install the chains; then use a 1" paint brush and lubricate both sides of chains with SAE-20 engine oil. Wipe off excess oil with a clean cloth. Adjust chains so fork carriage is level and all slack is removed from the lift chains.

C. LIFT CYLINDER-CLUSTER REMOVAL (20-55 SERIES)

1. With lift cylinders fully retracted and carriage resting on ground, disconnect lift chains from cylinder cluster.
2. Disconnect hydraulic hoses, and fittings (including flow-regulator), and plug or cap all hydraulic openings to prevent entry of any contaminants.
3. Remove the crosshead assembly, ram protecting rod, chain and guard from cluster cylinder assembly.
4. Remove cylinder cluster retaining nut (or retaining plate as applicable) at bottom of outer mast.
5. Remove the capscrews, lockwashers, and spacers at the top of the inner mast upright.
6. Carefully remove the cylinder cluster from the outer and inner masts.

NOTE: Refer to REPAIR MANUAL for DISASSEMBLY, INSPECTION, REPAIR and REASSEMBLY.

D. LIFT CYLINDER-CLUSTER INSTALLATION (20-55 SERIES)

CAUTION: Prior to lift cylinder installation, be certain that all hoses and fittings are clean and that there is no foreign matter in the cylinder inlet port.

1. Install all fittings and clamps previously removed from cylinder, and install the flow regulator.
2. To install the cylinder cluster assembly, first ensure that the crosshead assemblies and ram protectors have been correctly installed at the outer cylinder rams, and that the chain adjusting screws and locknuts have been installed.
3. Attach a properly rated hoist chain to the cylinder cluster assembly and maneuver cluster assembly into its relative mounting position within the inner and outer masts.
4. Install attaching capscrews and lockwashers which secure the cylinder cluster to inner mast. Tighten mounting capscrews.
5. Install and reconnect the cylinder cluster adjusting screws.

NOTE: Refer to LIFT CHAIN ADJUSTMENT Paragraph E of this Topic, prior to operational use of lift truck.

NOTE: Refer to following paragraph F for LIFT CYLINDER BLEED SERVICE.

E. LIFT CHAIN ADJUSTMENT

When it becomes apparent that the fork carriage is not level, that the lift chains are loose, or that the forks (or attachments) are higher than .25" to .50" above the floor when the lift cylinder is fully lowered, then the lift chains require adjustment.

NOTE: ALL CLUSTER CYLINDERS are adjusted with the PRIMARY Cylinders FULLY extended.

To adjust the chain length, refer to Figure 3-1 for a general view of chain anchor and use the following outline:

1. Position the mast assembly so it is vertical. Ensure that the inner mast section and lift cylinder are in the fully lowered position.
2. Loosen the chain anchor locknuts (Fig 3-1).
3. Chain tension is adjusted by increasing or decreasing the chain lengths with the adjusting nuts. Alternately tighten or loosen the chain on one side and then on the opposite side, until the chains are snug, with no slack and carriage forks clear the floor within .25" to .50".
4. Make certain that the lift chain tension is equal on each chain and that the fork carriage is level.
5. After the adjustment is completed, tighten the locknuts securely and make certain anchors were not turned.

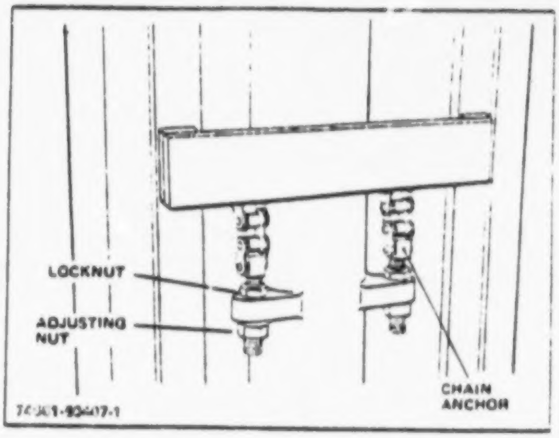


Figure 3-1. Chain Adjustment (On Cylinder)

F. LIFT CYLINDER BLEED SERVICE

1. Raise mast until forks are approximately 3 feet off of the ground.
2. Open cylinder bleed screw(s).

   Leave open until a stream of PURE HYDRAULIC OIL comes out.

NOTE: Be sure the oil being emitted is free of any air bubbles that may be seen only under close inspection. Leave bleed screws open until pure oil comes out.

3. Close bleed screw(s) tight.
4. Check hydraulic oil level; fill if required with pre-filtered specified oil.
5. Raise and lower mast to check for leaks, if any, and repair as necessary.

TOPIC 2. SIDE SHIFTER

A. DESCRIPTION

The integral side shift carriage enables the operator to rapidly and accurately position loads and to make more efficient use of available storage areas with a minimum of lift truck jockeying.

The cylinder is enclosed within the steel structure of the carriage frame, minimizing the possibility of damage.

B. 50 HOUR SERVICE

Wear strips and angles are provided which virtually eliminate sliding friction. Several grease fittings are installed at the wear points to ensure proper lubrication. Lubricate these fittings every 50 hours of operation.

C. REMOVAL/INSTALLATION

First disconnect hydraulic hoses at junction block on carriage frame, then refer to TOPIC 1 and perform applicable removal (or installation) procedure.

NOTE: For bearing adjustment, refer to preceding Topic 1.

D. SIDE SHIFTER CYLINDER REMOVAL

1. Remove cotter pin and rod pin from cylinder rod.
2. Retract cylinder rod far enough to clear rod retainer on side shift plate.
3. Disconnect hydraulic hoses from cylinder. Plug cylinder ports and hydraulic hose ends to prevent entry of foreign material.
4. Remove cotter pin and cylinder retainer pin and lift out cylinder.

E. SIDE SHIFTER CYLINDER INSTALLATION

1. Install anchor pin and cotter pin to cylinder and carriage frame.
2. Connect hydraulic hoses.
3. Extend cylinder rod and install retaining pin and cotter pin.

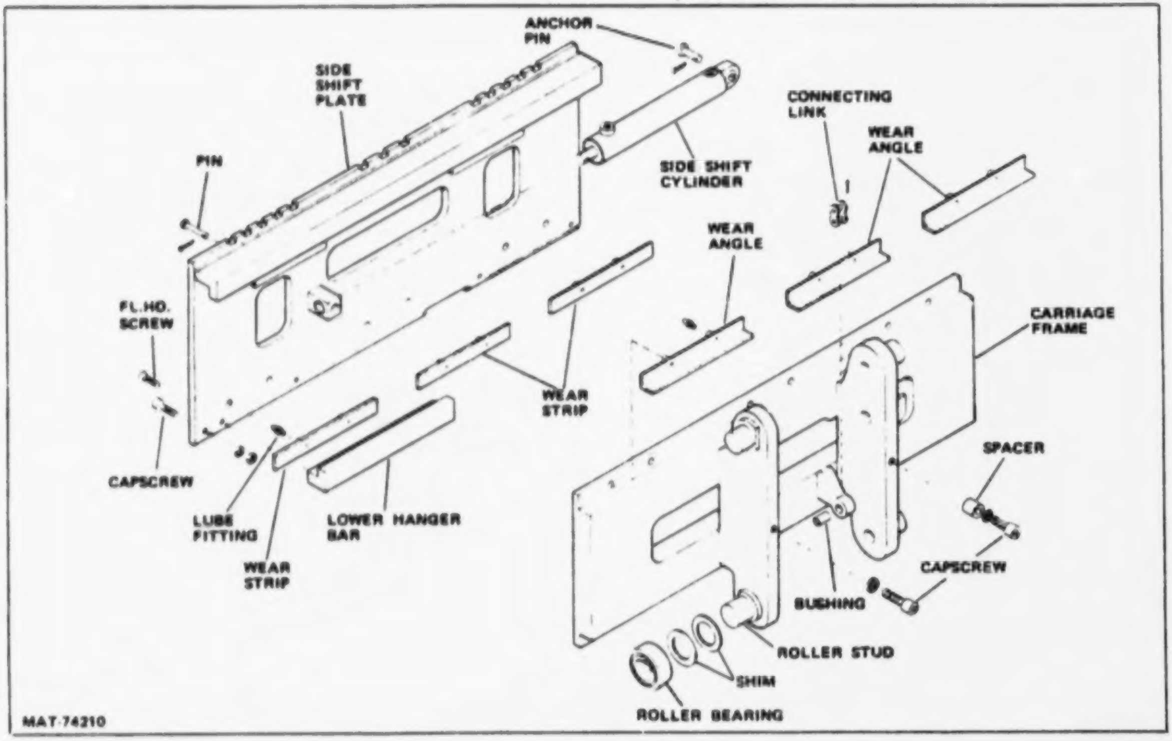

ANCHOR PIN
SIDE SHIFT PLATE
CONNECTING LINK
WEAR ANGLE
PIN
SIDE SHIFT CYLINDER
WEAR ANGLE
CARRIAGE FRAME
FL.HD. SCREW
WEAR STRIP
SPACER
CAPSCREW
LUBE FITTING
LOWER HANGER BAR
WEAR STRIP
CAPSCREW
BUSHING
ROLLER STUD
SHIM
ROLLER BEARING
MAT-74210

Figure 7. Side Shift Components

TOPIC 3. FORKS

A. DESCRIPTION

Basically, there are two types of forks, the shaft style (Fig 8) which pivots on a horizontal support shaft, and the more commonly used hook style fork (Fig 9) which hooks into notches along the top edge of the fork carriage. The standard or hook type fork will be discussed here. Any differences will be noted in shaft type removal and installation.

The forks should always be adjusted on the carriage to obtain the optimum balance in proportion to the width of the anticipated loads.

A fork lock (Fig 10), is installed in the top of each of the hook type forks to hold it in position in one of the notches along the top bar of the carriage. To change the fork location, pull up on the lock and move fork to the left or right. Allow fork lock to seat in the notch nearest to location chosen.

CAUTION: Naturally, the weight of each fork depends upon its size. Therefore, exercise caution while fork is being removed from the carriage to avoid injury to personnel and to prevent damage to the equipment.

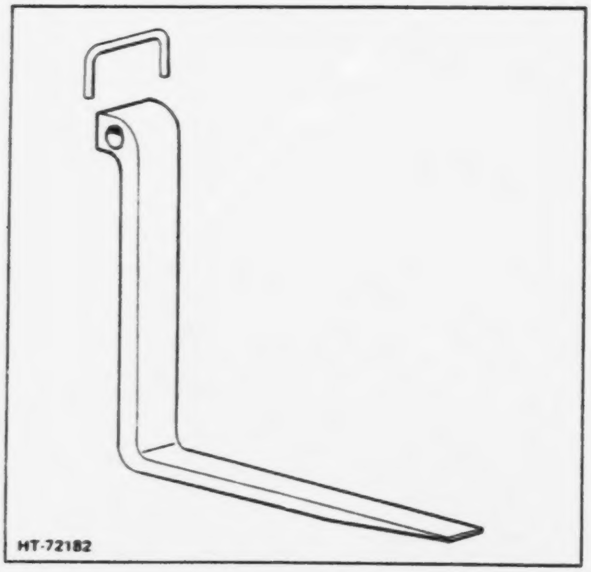


Figure 8. Shaft Style Fork

B. REMOVAL

(Hook Type)

1. Lower fork carriage until base of fork just clears the floor.
2. Release the fork lock pin and slide fork to a position over the slot in the lower carriage bar (Fig 10).
3. Tilt the lower portion of the fork forward and upward to release the lower hanger bar (Fig 9) from the lower carriage bar.
4. Refer to CAUTION in preceding Paragraph A; lift fork off upper carriage bar.

(Shaft Type)

1. Place support block under lower portion (bottom flat) of fork.
2. Drive securing roll pin (or retaining plate, if applicable) from horizontal support shaft in carriage frame; then carefully drive support shaft far enough to side to allow removal of fork.

C. INSPECTION

1. Inspect hook fork and locking mechanism for any evidence of wear or damage.
2. If locking mechanism is worn or damaged, remove and replace it as a unit.
3. If fork is defective, then replace with same type and capacity rated fork.

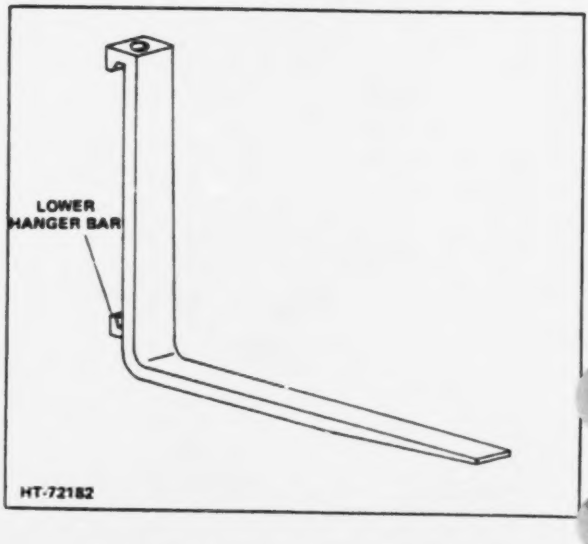


Figure 9. Hook Style Fork

D. INSTALLATION

(Hook Type)

1. Carefully lift fork up onto upper carriage mounting slot, then slowly lower until back of fork rests against carriage face and fork lower hanger bar passes through lower carriage cutout.
2. Release the fork lock pin and slide fork left or right until properly positioned for anticipated load clearance/balance requirements.

(Shaft Type)

1. Place appropriate support blocks (at tentative fork mounting area) at base of carriage assembly.
2. Carefully place fork on block and maneuver fork until horizontal support shaft can be properly aligned with fork mounting hole.
3. Press horizontal shaft through fork and into carriage frame; take care to align shaft roll pin hole with hole in carriage frame.

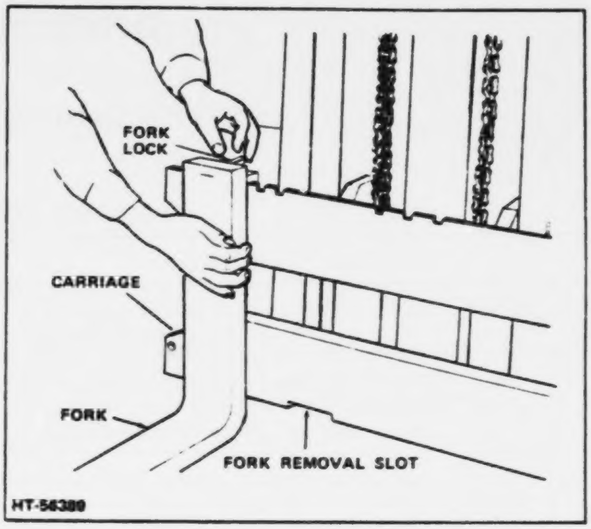


Figure 10. Fork Adjustment and Removal

4. Securely install shaft retaining roll pin (or retaining plate, if applicable).
5. Slide fork left or right to allow for proper load balance.

MEMO

TROUBLESHOOTING

TOPIC 1. TROUBLESHOOTING CHARTS

A. GASOLINE FUEL SYSTEM

TROUBLE	PROBABLE CAUSE	POSSIBLE SOLUTION
Engine hard to start or will not start.	Air in line.	Locate cause of air entry and repair or replace defective part.
	Water in the fuel.	Let stand. When the water has settled to the bottom, drain it from the carburetor, fuel pump sediment bowl, and fuel tank.
	Gasoline flow obstructed.	Check fuel lines, carburetor screen, fuel valves in fuel pump, and fuel pump sediment bowl. Locate and remove obstructions.
	Carburetor choke not set properly.	Adjust.
Engine stops suddenly.	No fuel.	Refill tank.
	Dirt in fuel.	Drain out. Refill with fresh fuel only after sediment bowl, carburetor, and gasoline tank have been cleaned.
	Dirt in filter.	Clean carburetor and air filters.
	Water in fuel.	See Engine Hard to Start.
	Plugged fuel line.	Disconnect fuel lines, blow out or remove obstruction.
	Air leak in fuel line or at fuel pump.	If in line, tighten connections or replace faulty tubing. If at fuel pump, repair fuel pump.
	Faulty fuel pump.	Repair fuel pump.
Engine knocks.	Improper fuel.	Drain complete fuel system. Refill with proper fuel.
	Lubricating oil thin or dirty.	Drain oil pan, clean out filter housing, replace with new filter, and add new oil of correct viscosity for the prevailing temperature.
	Carburetor choke not set properly.	Adjust.
Loss of power	Low oil pressure, due to (a) external oil leaks, (b) thin oil, or (c) sticking of oil pressure relief valve.	(a) Repair leaks by tightening the connections or replacing the line, (b) drain and fill with fresh oil, (c) remove oil pressure relief valve and clean. Do not stretch spring.
	Air leak at fuel line or fuel pump.	Tighten connection, or if leak is in the fuel pump, tighten or repair pump.
	Air cleaner obstructions.	Clean air cleaner and tubing; tighten connections.

A. GASOLINE FUEL SYSTEM (CONT)

TROUBLE	PROBABLE CAUSE	POSSIBLE SOLUTION
Loss of power (Continued)	Choke valve out of adjustment.	Adjust.
	Improper fuel.	Use only a good grade of gasoline.
	Improper governor adjustment.	Adjust link rod.
Engine runs irregularly (sputters).	Air leaks in carburetor gaskets.	Tighten or replace gaskets in carburetor.
	Partially closed tank shut-off.	Open.
	Water and sediment in carburetor.	Let water settle to bottom and drain. Drain out sediment, and clean screens. Check source of supply.
	Fuel lines partially blocked.	Check line; remove obstruction and any kinks in tubing.
	Fuel pump failure.	Repair or replace pump.
	Clogged air cleaner.	Clean.
	Loose jets in the carburetor.	Remove carburetor and tighten.
Smoky exhaust.	Carburetor float sticking. (Black smoke.)	Tap carburetor lightly with hammer handle. If this does not correct the situation, carburetor must be cleaned.
No gasoline at the carburetor.	Fuel pump faulty, clogged suction line.	Check the fuel lines between the tank and the fuel pump and the carburetor.
	Float stuck (dirty needle valve).	Tap the carburetor bowl gently. Or remove the carburetor, and clean the needle valve and float chamber.
	Fuel tank empty.	Refill.
	Air leak.	Check all connections and fuel lines between the carburetor, fuel pump, and tank.
Engine surges.	Surge screw out of adjustment (governor).	Adjust.
	Lean gasoline mixture. Water in the gas.	Adjust carburetor. Drain gas tank. Check source of supply.
Carburetor leaks gasoline with idling.	Float stuck (dirty needle valve).	Tap carburetor gently to dislodge the dirt in the fuel valve. If this does not correct the condition, remove the carburetor and clean the valve.
	Float level incorrect.	Adjust.
	Drain plug not tight.	Tighten.

B. COOLING SYSTEM

TROUBLE	PROBABLE CAUSE	POSSIBLE SOLUTION
Loss of coolant.	Leaks at hose or hose connections.	Replace hose.
	Cracked engine block or head.	Replace damaged part.
	Defective head gasket.	Replace.
	Leaking radiator.	Repair or replace.
	Drain cocks loose or open.	Repair.
	Leaking water pump.	Repair or replace.
	Thermostat remains closed.	Replace thermostat.
Overheating.	Inoperative instrument panel gauge or sending unit.	Replace inoperative unit.
	Thermostat does not open.	Replace thermostat.
	Loose fan belt.	Adjust or replace belt.
	Surface of radiator core clogged.	Clean the core.
	Obstruction in cooling system.	Clean out cooling system.
	Damaged or worn out water pump.	Repair or replace.
	Leak in cooling system.	Repair.
Rapid wear or breakage of fan belt.	Incorrect adjustment.	Readjust.
	Incorrect belt.	Replace with correct type.
	Fan blades striking belt.	Repair or replace fan.
	Excessive alternator drag.	Check alternator bearings.
	Broken or rough pulleys.	Replace pulleys.
Fan or water pump noisy.	Worn or damaged bearing or seal.	Replace worn or damaged parts.
	Loose fan blades.	Repair or replace fan.
	Broken pump impeller.	Repair.
	Excessive pump shaft end play.	Repair.
	Loose fan hub.	Tighten.

C. HYDRAULIC SYSTEM

TROUBLE	PROBABLE CAUSE	POSSIBLE SOLUTION
Unable to lift or tilt load.	Load too heavy.	Check capacity on Serial No. Plate.
	Insufficient or no oil.	Check tank for proper oil level and plugged suction line.
	Air leak at suction line.	Tighten connections.
	Damaged or worn pump.	Remove and repair.
	Relief valve binding open.	Remove and repair.
	Broken lift chains.	Repair.
	Obstruction in hydraulic lines.	Check flow of oil from pump through hydraulic system.
	Damaged lift cylinder.	Check for binding or any reason for inoperative plunger.
	Control valve inoperative.	Inspect for internal leakage or damaged parts and repair.
Lift and tilt too slow.	Engine speed governed too low.	Inspect governor controls and adjustment.
	Internal leakage at pump.	Inspect for worn or damaged parts.
	Excessive leakage at cylinder packing.	Repair or replace packing.
	Air leaks in system.	Tighten all connections.
	Misalignment.	Check masts, carriage or tilt linkage for cause of binding.
	Faulty relief valve.	Check for worn or damaged parts. Repair or replace. Check relief valve setting.
Load creeps-tilting or lowering.	Internal leakage in cylinders.	Repair or replace packing.
	Oil leak at packing glands.	Repair or replace packing.

C. HYDRAULIC SYSTEM (CONT)

TROUBLE	PROBABLE CAUSE	POSSIBLE SOLUTION
Load creeps-tilting or lowering. (Continued)	Leak in control valve.	Check for worn or damaged plungers.
	Leaks in oil lines.	Tighten all connections or replace damaged lines.
Noisy hydraulic pump.	Insufficient or no oil.	Check tank for proper oil level or restricted suction line.
	Air leaks.	Tighten intake connections.
	Air bubbles in intake oil.	Use hydraulic oil with antifoaming characteristics.
	Oil reservoir breather restricted.	Replace breather.
	Coupling misalignment.	Realign.
	Pump head loose.	Tighten.
	Worn or broken parts.	Replace.
Hydraulic oil overheating.	Pump too tight after overhaul.	Remove and repair.
	Restricted lines.	Check and repair.
	Relief valve set too high.	Valve should be set as recommended.
	Incorrect oil.	Drain, replace filter and use only recommended oil.
	Internal oil leakage.	Repair or replace pump.

D. DRIVE UNIT

TROUBLE	PROBABLE CAUSE	POSSIBLE SOLUTION
Failure to operate.	Broken jackshaft/axleshaft.	Replace jackshaft/axleshaft.
	Teeth broken out of jackshaft, bull gear, axleshaft, or planetary cluster.	Replace jackshaft, bull gear, axleshaft, or planetary.
	Broken teeth on ring gear or pinion.	Replace ring gear and pinion.
Axle noise on drive or coast.	Excessive wear at ring gear and pinion.	Adjust, if possible, or replace.
	Worn pinion gears or side gears in differential case.	Replace worn gears.
Continuous axle noise.	Excessive wear in gears.	Replace worn parts.
	Lack of lubrication.	Lubricate with specified lubricant.
	Uneven tire wear.	Replace tires.
	Worn or damaged bearing.	Replace bearings.

D. DRIVE UNIT (CONT)

TROUBLE	PROBABLE CAUSE	POSSIBLE SOLUTION
Excessive backlash on unit.	Worn splines on jackshaft/axleshaft.	Replace jackshaft/axleshaft.
	Worn ring gear or pinion.	Replace gear and pinion.
	Loose or worn universal joints.	Tighten or replace.

E. HYDRAULIC BRAKE SYSTEM

TROUBLE	PROBABLE CAUSE	POSSIBLE SOLUTION
Pedal goes to toe board.	Normal lining wear.	Check, repair, or replace self-adjuster.
	Low fluid level in master cylinder.	Fill reservoir and bleed lines.
	External leak in brake system or leak past master cylinder piston cup.	Check system for leak and repair.
	Air trapped in hydraulic system.	Bleed system.
Both brakes drag.	Pedal lash not correctly adjusted.	Readjust to correct lash.
	Mineral oil in brake system.	Clean out system, replace cups in wheel cylinders and master cylinder. Refill master cylinder with specified brake fluid and bleed brake system.
	Breather port in master cylinder clogged.	Clean out breather port.
One wheel drags.	Weak or broken brake shoe return springs.	Replace broken or weak springs.
	Brake shoe or drum clearance too small.	Check, repair, or replace self-adjuster.
	Tight wheel bearing.	Readjust.
	Obstruction in brake line.	Remove obstruction or replace line.
	Swollen wheel cylinder piston cups or piston binding.	Replace defective or damaged parts.
Truck pulls to one side.	Grease or brake fluid on brake lining.	Replace with new lining.
	Loose wheel bearings.	Readjust.
	Different makes of brake lining.	Make sure same type of lining is used at each wheel.
	Brakes incorrectly set.	Readjust.
	Uneven tread wear.	Replace tires.

E. HYDRAULIC BRAKE SYSTEM (CONT)

TROUBLE	PROBABLE CAUSE	POSSIBLE SOLUTION
Truck pulls to one side. (Continued)	Lining charred or drum scored.	Replace lining or repair or replace drum.
	Adjusting cams loose.	Repair.
Brakes spongy.	Air trapped in brake system.	Bleed brake system.
	Brake adjustment not correct.	Check and/or replace self-adjuster.
	Shoe surface not square with drum.	Repair.
Excessive pedal pressure.	Brake adjustment not correct.	Check and/or replace self-adjuster.
	Incorrect brake lining.	Install specified lining.
	Oil or fluid soaked lining.	Replace lining.
	Lining making only partial contact.	Realign brake shoes.
Light pedal pressure-brakes too severe.	Brake adjustment not correct.	Check and/or replace self-adjuster.
	Small amount of grease or brake fluid on lining.	Correct cause and replace lining.
	Incorrect lining.	Install specified lining.
Brakes squeak.	Brake shoes twisted.	Repair.
	Particles of metal or dust imbedded in lining.	Remove foreign material; sand lining to drum.
	Chamfer at end of lining too short.	Elongate chamfer.

F. POWER STEERING SYSTEM

TROUBLE	PROBABLE CAUSE	POSSIBLE SOLUTION
Hard steering.	Failure of pump.	Replace or recondition.
	Badly worn pump.	Recondition pump.
	Broken or weak relief valve spring.	Replace spring.
	Binding relief valve.	Free valve.
	Low pump pressure.	Replace worn or faulty parts.
	Line leakage.	Tighten connections.
	Low oil level.	Fill reservoir to correct level.
	Bent linkage.	Replace damaged parts.
	Improper wheel alignment.	Align wheels.

F. POWER STEERING SYSTEM (CONT)

TROUBLE	PROBABLE CAUSE	POSSIBLE SOLUTION
Hard steering. (Continued)	Lack of lubrication.	Lubricate.
	Leakage in steer cylinder.	Repair.
	Air in system.	Bleed the system.
	Faulty regulator valve.	Recondition valve.
	Faulty control valve.	Repair or replace.
Steering too sensitive.	Faulty flow control valve.	Recondition - free any binding parts.
Loose steering.	Wheels out of alignment.	Align wheels.
	Loose linkage.	Tighten linkage or replace.
	Worn king pins.	Replace.
	Wheel bearings loose or worn.	Adjust bearings or replace.
	Air in system.	Bleed the system.
	Steering gear out of adjustment.	Adjust cam and worn shaft.
Low oil pressure.	Low oil level.	Fill reservoir to correct level.
	Worn pump.	Recondition or replace.
	Weak relief valve spring.	Replace spring.
	Relief valve stuck open.	Remove and free valve.
	Flow control valve stuck open.	Free flow control valve.
	External leakage.	Tighten or replace fittings, hoses, or seals.
	Internal leakage.	Replace seals in valves or cylinders.

G. MAST HYDRAULIC SYSTEM

TROUBLE	PROBABLE CAUSE	POSSIBLE SOLUTION
Unable to lift or tilt load.	Relief valve binding open.	Remove and repair.
	Broken lift chains.	Repair or replace.
	Obstruction in hydraulic lines.	Check flow of oil from pump through hydraulic system.
	Damaged lift cylinder.	Check for binding or any reason for inoperative plunger.
	Load too heavy.	Check capacity on Serial No. Plate.

G. MAST HYDRAULIC SYSTEM (CONT)

TROUBLE	PROBABLE CAUSE	POSSIBLE SOLUTION
Lift and tilt too slow.	Engine speed governed too low.	Inspect governor controls and adjustment.
	Excessive leakage at cylinder packing.	Repair or replace packing.
	Air leaks in system.	Tighten all connections.
	Misalignment.	Check masts, carriage or tilt linkage for cause of binding.
	Faulty relief valve.	Check for worn or damaged parts. Repair or replace. Check relief valve setting.
Load creeps-tilting or lowering.	Internal leakage in cylinders.	Repair or replace packing.
	Oil leak at packing glands.	Repair or replace packing.
	Leaks in oil lines.	Tighten all connections or replace damaged lines.
Oil over-heating.	Relief valve set too high.	Valve should be set as recommended.

H. POWER SHIFT TRANSMISSION

TROUBLE	PROBABLE CAUSE	POSSIBLE SOLUTION
Transmission won't shift into gear/out of gear.	Improperly adjusted or disconnected linkage.	Adjust or reconnect shifting linkage.
	Transmission overheated.	Check fluid level; refill to proper level if low. Check for leaks. Check specified operating pressures.
	Defective pump.	Repair or replace as necessary.
	Defective control valve.	Repair or replace as necessary.
Transmission is sluggish/jerky.	Parking brake not released.	Release parking brake; check parking brake drum for any possible damage.
	Fluid level low.	Check fluid level; refill to recommended capacity if necessary.
	Faulty or worn components.	Check torque converter operation, pump, clutch-pack, control valve. Check the specified operating pressures. Repair or replace any defective parts.
Transmission does not shift smoothly.	Linkage improperly adjusted.	Adjust shifting linkage.
	Fluid level low.	Check fluid level; refill to recommended level if necessary.
	Malfunctioning control valve.	Verify proper operation of control valve; repair, adjust or replace if necessary.

H. POWER SHIFT TRANSMISSION (CONT)

TROUBLE	PROBABLE CAUSE	POSSIBLE SOLUTION
Inching pedal does not slow or stop truck.	Improperly adjusted.	Adjust inching pedal stop bolt.
Transmission won't shift into LOW or HIGH gear speed. (If so equipped.)	Improperly adjusted or disconnected linkage.	Adjust or reconnect shifting linkage.
	Fluid level low.	Check fluid level; refill to recommended capacity if necessary.
Transmission "jumps" out of gear.	Improperly adjusted linkage.	Adjust linkage.
	Mechanical obstruction.	Inspect linkage for any improper routing or possible obstruction that forces linkage out of desired position; remove obstruction.

I. ELECTRICAL SYSTEM

TROUBLE	PROBABLE CAUSE	POSSIBLE SOLUTION
Ammeter reading "Zero" with ignition switch "On" and engine being rotated.	Defective ignition switch.	Replace switch.
	Defective ammeter.	Replace.
	Broken or loose wiring at ignition switch.	Repair or replace wiring.
Ammeter does not show charge.	Defective regulator.	Adjust or replace regulator.
	Defective stator.	Repair or replace windings.
	Worn alternator brushes.	Replace brushes.
	Shorted alternator armature.	Repair or replace armature.
	Defective rectifying diodes in alternator.	Replace.
	Shorted alternator fields.	Repair or replace alternator.
	Slip rings dirty or worn.	Clean slip rings or repair or replace alternator.
	Defective wiring.	Check for loose, broken, or disconnected wires.
Ammeter shows excessive charge..	Defective current control in regulator.	Repair or replace regulator.
	Battery run down.	Recharge or replace battery.
	Defective alternator.	Repair or replace.
	Defective ammeter.	Replace.

L. ELECTRICAL SYSTEM (CONT)

TROUBLE	PROBABLE CAUSE	POSSIBLE SOLUTION
Ammeter shows discharge during engine operation.	Inoperative alternator.	Repair or replace.
	Faulty regulator controls.	Replace regulator.
	Shorted circuits.	Check for faulty circuit and repair.
	Fan belt loose or broken.	Adjust or replace belt.
Excessive battery water usage.	Shorted battery cell.	Replace.
	High regulator setting.	Adjust.
Starting motor failure.	Broken connections.	Reconnect or replace wires.
	Faulty switches.	Check ignition switch or starter button.
	Battery dead or low charge.	Replace or recharge battery. Check for low regulator setting.
	Commutator dirty.	Clean.
	Worn brushes.	Replace.
	Broken drive.	Replace.
Ammeter shows heavy discharge with engine stopped.	Shorted circuits.	Trace wiring for shorts.
	Defective voltage regulator.	Inspect for closed contacts. Adjust or replace regulator.
	Defective ammeter.	Replace.
Ammeter shows rapid fluctuation.	Loose alternator drive belt.	Readjust.
	Shorted or loose connections.	Trace wiring for breaks or looseness.
	Dirty, loose, or worn alternator brushes.	Clean and tighten brushes. Replace if worn.
	Defective alternator.	Repair or replace.
	Voltage regulator out of adjustment.	Readjust.
Horn does not blow.	No current to horn.	Check for broken wire or dead battery.
	Faulty horn button.	Check for faulty ground or replace horn button.
	Defective horn.	Replace.
	Defective horn relay.	Replace.
Horn blows continuously.	Grounded horn wire.	Eliminate ground. Check for frayed wire.
	Shorted horn.	Replace horn.
	Defective horn button.	Replace.
	Faulty relay.	Replace.

LUBRICANT AND FUEL SPECIFICATIONS

TOPIC 1. LUBRICANT SPECIFICATIONS

A. ENGINE LUBRICATING OIL

The basic requirements for lubricating oils used in Allis-Chalmers engines are:

1. Maintain pistons, rings, and other moving parts in a carbon free, varnish free, and clean condition.
2. Maintain enough body to satisfactorily lubricate the moving parts at maximum oil temperatures.
3. Prevent bearing corrosion. Counteract corrosive products of combustion or contaminants in the fuel.
4. Promote general cleanliness within the engine.

The American Petroleum Institute has several service classifications for oils used in gasoline and L. P. gas engines; they are SA, SB, SD, and SE. For diesel engines, the classifications are CA, CB, and CD.

SERVICE SA and CA: Service typical of engines used under light and favorable operating conditions, the engines having no special lubrication requirements and having no design characteristics sensitive to deposit formation.

SERVICE SB and CB: Service typical of engines used under moderate to severe operating conditions, but presenting problems of deposit corrosion control when lubricating oil temperatures are high.

SERVICE SD and CD: Service typical of engines used under unfavorable or severe types of operating conditions and where there are special lubrication requirements for deposit, wear, or bearing corrosion control, due to operating conditions, or engine design, or fuel characteristics.

SERVICE SE: Oils designed for this service provide more protection against oil oxidation, high temperature engine deposits, rust, and corrosion in gasoline engines than oils which are satisfactory for classification SD.

Generally, SERVICE SB will apply to the gasoline or L. P. gas engines, and SERVICE CB will apply to the diesel engines.

Use oils of the following viscosities:

Atmospheric Temperature	Viscosity
Below 32°F	SAE 20
32°F to 90°F	SAE 30
Above 90°F	SAE 40

Our recommendation of 100 hours for filter and oil change periods is based on the use of high quality oils and 85% average engine loads with the engine in good adjustment and operating with the coolant and lubricating oil at normal operating temperature. Variations from the considered normal operating conditions must be compensated for by the use of premium grade oils or more frequent oil change and filter change periods, or both.

Our recommended oil change periods are based on what experience has shown to be conservative and safe hours of operation between oil changes. Actual testing of the lubricating oil in any particular engine application at each 5 to 10 hours operation after 100 hours operation to determine the condition of the oil may allow extending the oil change periods. This testing service is provided by most major oil companies. It is recommended to take advantage of this service.

B. HYDRAULIC SYSTEM OIL

Use a hydraulic oil that conforms to Allis-Chalmers specification H-100 or SAE 10 SE engine oil (or MIL-L-2104B) in the hydraulic system.

The hydraulic oil must be fortified with special rust and oxidation inhibitors, plus anti-wear ingredients, and treated to minimize foaming. The hydraulic oil must conform to the following in Allis-Chalmers specification H-100:

Viscosity at 100°F SUS	150 - 170 secs
Viscosity Index	90 min
Flash Point	370°F min
Neutralization No. (mgs KOH/g oil)	0.60
Aniline Point	180 - 220°F
Oxidation Stability (hrs. to neut. No. 1.0 max)	1500
Rust Test	Pass
Copper Strip Corrosion (3 Hours at 212°F)	Pass 2B
Pour Point	-20°F max

The SAE grade 10 SE engine oil is available at all major oil companies and most local service stations. The oil meets the requirements of the American Petroleum Institute and contains rust [illegible]d oxidation inhibitors, anti-wear ingredients, [illegible]l an anti-foaming agent.

If the hydraulic system oil is stored in large con[illegible]ers, the storage containers must be kept free [illegible]ontaminants, such as dirt, water, and metal [illegible]ps. Contaminated hydraulic oil is the major cause of hydraulic system failures. It is recommended that each storage container be clearly marked - FOR USE IN HYDRAULIC SYSTEM ONLY.

C. POWER SHIFT TRANSMISSION OIL

Use a good quality type "A" or suffix "A" automatic transmission fluid available from any major oil company.

D. DIFFERENTIAL, STANDARD SHIFT TRANSMISSION, PLANETARY GEAR, AND STEERING GEAR OIL

Lubricate these assemblies with SAE 90 EP (extreme pressure) gear oil which is non-corrosive and resists oxidation and foaming. It should have a low pour point to ensure quick lubrication at [illegible]her high or low temperatures.

E. BULL GEAR AND JACKSHAFT PINION

Lubricate with high quality, Grade 2 lithium base grease (characterized by the word "Moly") that contains a maximum of 5% micronized molybdenum disulfide. Lubricant must be waterproof and heat resistant.

F. WHEEL BEARINGS AND JACKSHAFT BEARINGS

Lubricate with a high quality, Grade 2 lithium base grease (characterized by the word "Moly") that contains a maximum of 5% micronized molybdenum disulfide. Lubricant must be waterproof and heat resistant.

G. PRESSURE GUN FITTINGS AND UNIVERSAL JOINT

Lubricate with a high quality chassis lubricant, N. L. G. I. Grade 2 heavy duty sodium base grease available from any reputable oil company.

H. OIL CAN POINTS

Lubricate all points with SAE 10 or 20 engine oil.

I. BRAKE MASTER CYLINDER

Use only premium quality, heavy duty brake fluid with an extreme heat-cold range that conforms to SAE specification J1703C.

J. MASTS

Lubricate all sliding surfaces of mast uprights with a high quality, Grade 2 lithium base grease (characterized by the word "Moly") that contains a maximum of 5% micronized molybdenum disulfide. Lubricant must be waterproof and heat resistant.

TOPIC 2. FUEL RECOMMENDATIONS (GASOLINE AND L. P. GAS)

A. GENERAL

Depending upon the owner's selection, the carburetors offered for the engine are designed for either gasoline or liquid petroleum gas carburetion.

1. Gasoline

For economy and performance on gasoline units, it is recommended that a good regular grade of gasoline with an octane rating of 89 or higher be used. The gasoline should meet the requirements of ASTM-D357-61 (motor method) and/or ASTM-D-908-61 (research method).

Low-lead and no-lead gasolines, from a reputable oil manufacturer, are acceptable for a lift truck equipped with a low emission engine. However, the low emission engine will still be low in emissions, regardless of whether a leaded or unleaded gasoline is used.

2. Liquid Petrolium Gas

Liquid petroleum fuel is a gas and is only in the liquid state when under pressure or extreme low temperature. When released from the tank, it vaporizes rapidly forming a gas that is heavier than air.

CAUTION: When storing unit in a closed building, be sure the fuel system contains no leaks. Leaks may be located by using liquid soap on valves, connections, etc. Keep all fire, sparks, static electricity, cigarette smoking, etc. out of building because serious explosions can occur.

A leak in L. P. Gas equipment is difficult to detect because the fuel vaporizes so readily that it does not leave a wet area around leak. However, rapid expansion and vaporization of the fuel causes refrigeration. Therefore, if frost is detected on fuel system components when unit is not in use, a leak is most likely present and should be repaired immediately.

CAUTION: Some states require a license to install, repair, and adjust liquid petroleum gas equipment. Check local regulations.

The fuel tank must not be filled above the 80% full level. The remainder of tank contains vapor given off by the fuel.

CAUTION: Never fill tank while engine is running. Never smoke while filling tank. Do not allow fuel or vapor to contact skin because the very low temperature may cause frostbite or freezing of affected areas.

B. FUEL STORAGE

The importance of proper fuel storage cannot be too strongly stressed. Storage tanks, drums, or service tanks must be free of rust, scale, sediment, or any other foreign material that will contaminate the fuel.

C. HANDLING OF FUEL (GASOLINE)

The following rules cover handling of fuel before it reaches the carburetor.

1. Do not handle fuel in an open container.
2. Do not use waste or linty rags around fuel containers.
3. Clean all storage tanks at regular intervals.
4. If hand pumps are used to bring fuel from storage tanks, keep them covered with dustproof covers when not in use.
5. When drawing fuel from a drum, agitate drum as little as possible and leave from 2 to 3 inches of fuel in bottom of drum.
6. Keep fuel handling equipment, such as measures, funnels, containers, etc., clean at all times and covered when not in use.
7. Use funnel equipped with a 200-mesh wire screen.

TOPIC 3. LUBRICATION AND SERVICE GUIDE

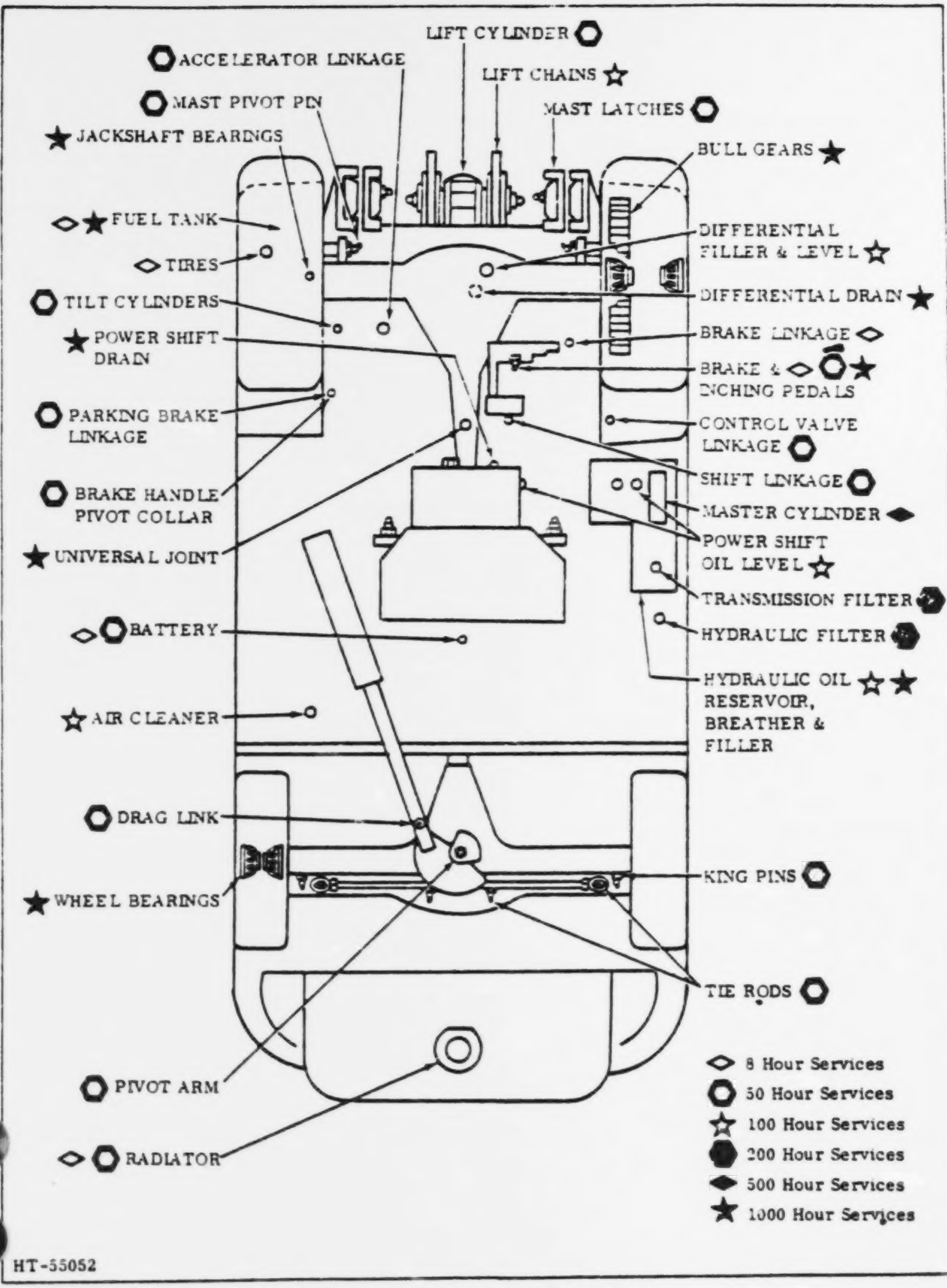

LIFT CYLINDER ⬡
⬡ ACCELERATOR LINKAGE
LIFT CHAINS ☆
⬡ MAST PIVOT PIN
MAST LATCHES ⬡
★ JACKSHAFT BEARINGS
BULL GEARS ★
◇★ FUEL TANK
DIFFERENTIAL FILLER & LEVEL ☆
◇ TIRES
⬡ TILT CYLINDERS
DIFFERENTIAL DRAIN ★
★ POWER SHIFT DRAIN
BRAKE LINKAGE ◇
BRAKE & INCHING PEDALS ◇⬡★
⬡ PARKING BRAKE LINKAGE
CONTROL VALVE LINKAGE ⬡
SHIFT LINKAGE ⬡
⬡ BRAKE HANDLE PIVOT COLLAR
MASTER CYLINDER ◆
★ UNIVERSAL JOINT
POWER SHIFT OIL LEVEL ☆
TRANSMISSION FILTER ⬢
◇⬡ BATTERY
HYDRAULIC FILTER ⬢
HYDRAULIC OIL RESERVOIR, BREATHER & FILLER ☆★
☆ AIR CLEANER
⬡ DRAG LINK
KING PINS ⬡
★ WHEEL BEARINGS
TIE RODS ⬡
⬡ PIVOT ARM
◇⬡ RADIATOR
◇ 8 Hour Services
⬡ 50 Hour Services
☆ 100 Hour Services
⬢ 200 Hour Services
◆ 500 Hour Services
★ 1000 Hour Services
HT-55052

Figure 1. Lubrication and Service Guide

MEMO

SECTION III

REPAIR INSTRUCTIONS

REPAIR INDEX

TOPIC TITLE PAGE

ENGINE ASSEMBLY

1 FITS & TOLERANCES 3-1
2 SERVICE 3-4
3 MANIFOLD 3-5
4 VALVES - INT & EXH 3-7
5 CYLINDER HEAD 3-13
6 CRANKSHAFT & BEARINGS 3-15
7 FLYWHEEL & HOUSING 3-23
8 PISTON & CONN ROD 3-27
9 CAMSHAFT & TAPPETS 3-33
10 GEAR TRAIN 3-35
11 CYLINDER BLOCK 3-39
12 OIL PUMP 3-43
13 OIL PRESSURE RELIEF VALVE 3-45
14 FILLER BLOCKS & GUARD 3-46
15 OIL PAN 3-48
16 RUN-IN SCHEDULE 3-49
17 REMOVAL/INSTALLATION 3-50

FUEL SYSTEM

1 FUEL SYSTEM 3-53
2 FUEL TANK 3-55
3 FUEL PUMP & FILTER 3-57
4 CARBURETOR 3-59
5 ACCELERATOR LINKAGE 3-67
6 GOVERNOR 3-69
7 AIR CLEANER 3-70

ELECTRICAL SYSTEM

1 BATTERY 3-71
2 ALTERNATOR 3-81
3 STARTER 3-91
4 DISTRIBUTOR 3-98
5 CONDENSOR 3-102

COOLING SYSTEM

1 DESCRIPTION 3-103
2 WATER PUMP 3-105
3 RADIATOR 3-109

1 EXHAUST SYSTEM 3-113

TRANSMISSION

1 TRANSMISSION 3-115
2 TORQUE CONVERTER & PUMP 3-125
3 DRUM & DISCS 3-127
4 CONTROL VALVE 3-129

1 UNIVERSAL JOINT 3-131

DRIVE AXLE

1 DRIVE AXLE 3-135
2 DIFFERENTIAL 3-142
3 PNEUMATIC WHEELS 3-146

TOPIC TITLE PAGE

BRAKE SYSTEM

1 DRIVE WHEEL BRAKES 3-147
2 MASTER CYLINDER 3-151
3 WHEEL CYLINDERS 3-153
4 PARKING BRAKE 3-153
5 BLEEDING THE BRAKE SYSTEM 3-155

STEERING SYSTEM

1 DESCRIPTION 3-157
2 STEER AXLE 3-157
3 STEERING VLAVE UNIT 3-163
4 CYLINDER & DRAG LINK 3-171
5 TIE RODS 3-175
6 STEER WHEELS 3-176

HYDRAULIC SYSTEM

1 HYDRAULIC PUMP 3-179
2 CONTROL VALVE 3-182
3 TILT CYLINDER 3-185

HIGH FREE LIFT MAST

1 MAST 3-189
2 CYLINDER REMOVAL/INSTALLATION 3-192

CARRIAGE, SIDESHIFTER & FORKS

1 CARRIAGE REMOVAL/INSTALLATION 3-195
2 CARRIAGE SERVICE 3-196
3 FORKS 3-197
4 WELDING PROCEDURE 3-199
5 **SIDESHIFTER** 3-201
6 **SIDESHIFTER CYLINDER** 3-202
HOSE REEL 3-204

CONTINENTAL ENGINE

TOPIC 1. FITS AND TOLERANCES

DESCRIPTION	F135	F163
A. PISTONS		
Piston Diameter		3.4372-3.4392
Cylinder Diameter		3.4395-3.4375
Wear Limits-Cylinder Bore	.008	
Piston Pin Hole Diameter	.8597-.8595	
Top Ring Groove Width	.081-.080	
Maximum Wear Limit Width	.083	
Second And Third Rings Groove Width	.0965-.0955	
Maximum Wear Limit Width	.0985	
Fourth Ring Groove Width		.2515-.2505
Maximum Wear Limit Width		.2535
Piston Fit-Feeler Gauge	.003	
lbs. Pull	5-10	
B. PISTON RINGS		
Top Ring Width	.078-.077	
Wear Limits-Minimum Width	.075	
Second and Third Rings Width		.0930-.0925
Wear Limits-Minimum Width		.0905
Fourth Ring Width		.248-.244
Wear Limits-Minimum Width		.0242
Top Ring Gap Clearance	.008-.018	
Second and Third Rings Gap Clearance	.008-.018	
Fourth Ring Gap Clearance	.015-.055	
Top Ring Side Clearance	.002-.004	
Second and Third Rings Side Clearance		.0025-.0040
Fourth Ring Gap Clearance		.0025-.0075
C. CONNECTING RODS		
Bushing Hole Diameter	.914-.913	
Bearing Hole Diameter	2.1870-2.1865	
Bearing Thickness	.0616-.0613	
Wear Limits-Minimum Thickness	.0608	
Crank Pin Diameter	2.0627-2.0619	
Wear Limits-Minimum Diameter	2.0609	
Clearance Limits	.0006-.0022	
Desired Clearance	.0015	
Wear Limits-Maximum Clearance	.0032	
Side Play	.010-.006	
Desired Side Play	.006	
D. PISTON PIN		
Length		2.878-2.868
Diameter	.8593-.8591	
Wear Limits-Minimum Diameter	.8588	
Desire Fit	Light Push	
Bushing Hole Diameter - Fin.	.8597-.8595	
Wear Limits-Maximum Diameter	.8607	
Pin Clearance in Bushing	.0006-.0002	
Desired Pin Fit	.0004	

NOTE: Where no specification is listed for the F163 engine it is identical to the specification for the F135 engine.

E. MAIN BEARINGS

	F135	F163
Bearing Bore in Block, Diameter	2.5622-2.5615	
Bearing Thickness	.0925-.0928	
Wear Limits-Minimum Thickness	.0920	
Main Bearing Journal Diameter	2.3752-2.3744	
Wear Limits-Minimum Diameter	2.3734	
Clearance Limits	.0007-.0028	
Desired Clearance	.0015	
Crankshaft End Play	.002-.006	
Center Flange Bearing		
Thickness	.0926- .0929	
Wear Limits-Minimum Thickness	.0921	
Clearance Limits	.0005-.0026	
Desired Clearance	.0015	

F. CAMSHAFT

Bearing Journal Diameter, Front	1.8725-1.8715	
Center	1.7465-1.7455	
Rear	1.2475-1.2465	
Wear Limits-Minimum Diameter (under minimum new shaft diameter)	.001	
Bushing Inside Diameter, Front	1.8755-1.8745	
Center	1.7502-1.7495	
Rear	1.2505-1.2495	
Bushing Clearance Limits	.004-.002	
End Play	.009-.005	
Camshaft Bore in Cylinder Block - Finish Reamed Front	2.0000-1.9995	
Center	1.8750-1.8740	
Rear	1.3750-1.3745	

G. INTAKE VALVES

Stem Diameter	.3414-.3406	
Wear Limits - Minimum Diameter	.3386	
Seat Angle	30°	
Stem Clearance Limits	.0026-.0008	
Wear Limits-Maximum Clearance	.0046	
Desired Stem Clearance	.0015	

H. EXHAUST VALVES

Stem Diameter	.3385-.3377	
Wear Limits-Minimum Diameter	.3357	
Seat Angle	45°	
Stem Clearance Limits	.0055-.0037	
Wear Limits-Maximum Clearance	.0075	
Desired Stem Clearance	.0045	

I. VALVE GUIDES

Outside Diameter	.6575-.6565	
Stem Hole Diameter	.3432-.3422	
Wear Limits - Maximum Diameter	.3447	
Contact Face to Guide	1.4688"	
Length	2.3125"	

NOTE: Where no specification is listed for the F163 engine it is identical to the specification for the F135 engine.

J. VALVE SPRINGS

	F135	F163
Outside Diameter	.9688"	
Length - Valve Closed	1.7031"	
Load - Valve Closed	47-53 lbs.	
Wear Limits - Minimum Weight	42 lbs.	
Length - Valve Open	1.4219"	
Load - Valve Open	96-104 lbs.	
Wear Limits - Minimum Weight	86 lbs.	

K. TIMING GEAR BACKLASH

Backlash between all gears	.002" - .004"	

L. FLYWHEEL AND HOUSING

Face run-out on wheel	.008" T.I.R.	
Housing bore run-out	.010" T.I.R.	
Housing face run-out	.006" T.I.R.	

M. TORQUE SPECIFICATIONS (lb. ft.)

Cylinder Head	70-75	
Main Bearing Caps	85-95	
Connecting Rods	40-45	
Flywheel	35-40	
Manifolds	25-30	
Gear Cover	50-55	
Oil Pan	12-16	
Flywheel Housing	50-55	
Camshaft Nut	175-180	

NOTE: Where no specification is listed for the F163 engine it is identical to the specification for the F135 engine.

TOPIC 2. ENGINE SERVICE AND MAINTENANCE, GENERAL INFORMATION

The disassembly, inspection and reassembly of the engine requires no unusual or special shop equipment. However, the following factors are very important and should not be overlooked.

DO NOT INTER-MIX ENGINE PARTS.

Mark for position on disassembly; tag assemblies from different engines; identify parts reground to special sizes.

DO NOT MIX BOLTS, CAPSCREWS AND WASHERS.

Capscrews and like parts are of a length, material and heat treatment suited to the place they are used.

INSPECT AS ENGINE IS DISASSEMBLED.

Once engine parts have been disassembled and cleaned, many valuable indications of engine condition are lost. Check generally for water leaks, oil leaks and signs of unusual or excessive wear.

PROTECT DELICATE PARTS AND SURFACES.

Do not pile engine parts, ignition equipment, carburetors or other miscellaneous items indiscriminately. Oil any surfaces likely to rust. Tape finished surfaces subject to scratching or nicking during repair operations.

CLEAN THOROUGHLY.

No engine is completely overhauled if it is not cleaned internally and externally to like-new condition. Thorough cleaning greatly aids disassembly and helps prevent the introduction of dirt onto bearings and running surfaces via the mechanic's hands, tools and the work bench.

WORK ACCURATELY.

Use precision gauges where needed. Follow specifications in TOPIC 1. FITS AND TOLERANCES.

LOCATION ON ENGINE.

Throughout this manual the terms right, left, front and rear are determined from the view point of the mechanic standing at and facing the flywheel end of the engine.

TOPIC 3. MANIFOLD

A. DESCRIPTION

The intake and exhaust manifold (Figure 3-1) is a one-piece casting which serves as a collector for the incoming fuel-air mixture and the outgoing exhaust gases. The carburetor is bolted to the intake section of the manifold and the exhaust pipe is attached to the exhaust manifold outlet flange. Gaskets are used between the manifold assembly and the cylinder block. Unless cracked or broken, the manifold requires very little attention.

B. REMOVAL

> CAUTION: Be certain engine has cooled prior to handling manifold, as severe burns could result from careless exposure.

Manifold can be removed with engine in or out of truck frame. The following procedure is recommended for efficient manifold removal.

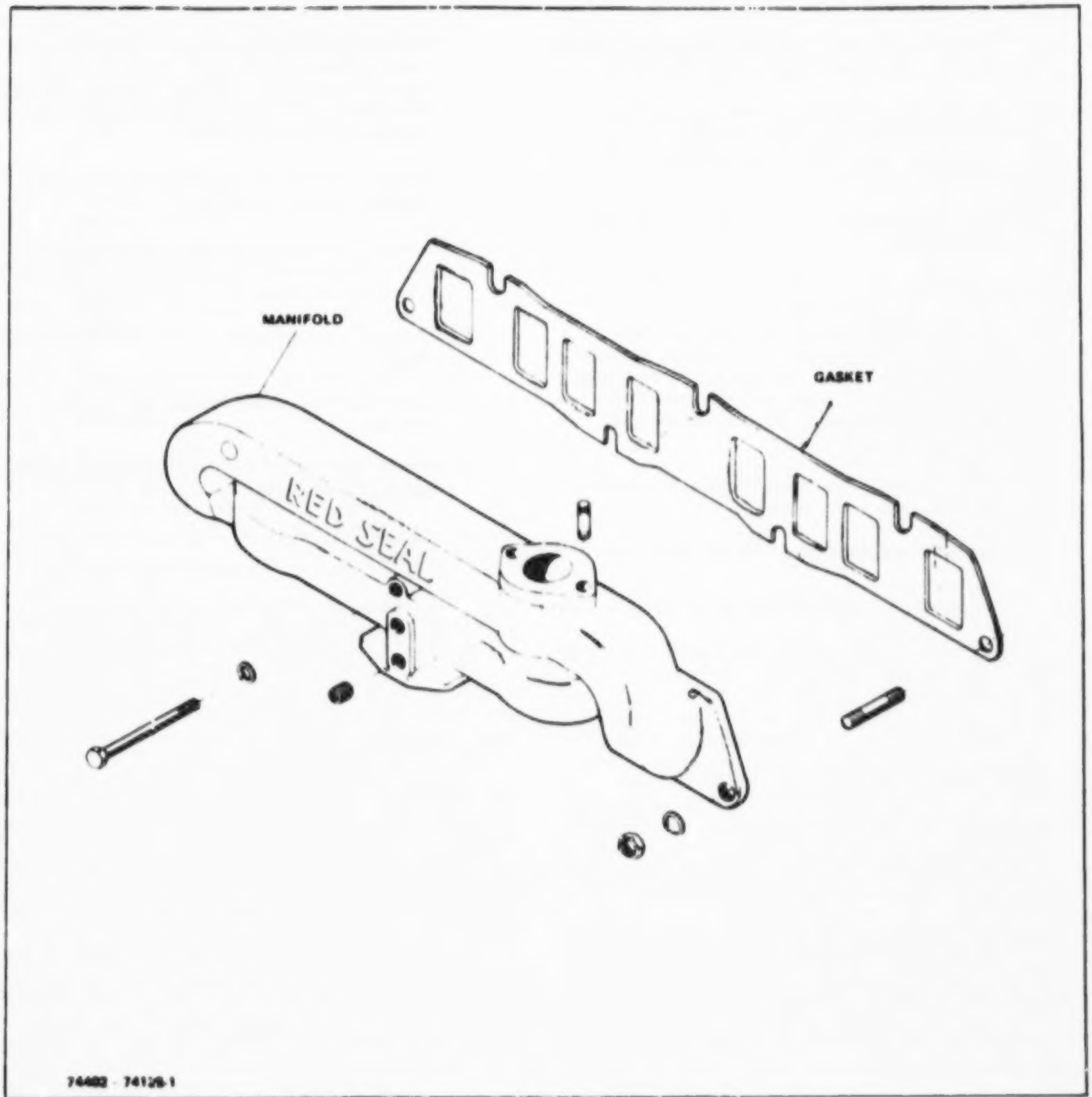


Figure 3-1. Intake/Exhaust Manifold

1. Remove side panels, air cleaner, seat and seat deck.

2. Remove carburetor air hose, and exhaust pipe.

3. Disconnect choke control, accelerator rod and governor control rod from carburetor.

4. Shut off fuel supply at base of fuel tank and disconnect fuel line at elbow.

5. Remove carburetor from manifold.

6. Disconnect hose from PCV valve and remove valve, hose and elbow from manifold.

7. Remove self-locking nuts and washers which attach manifold assembly to cylinder head and slide assembly off mounting studs.

8. Remove retainers and gaskets from manifold ports.

C. INSPECTION

1. The manifold should be checked for cracks and warpage. If cracked, assembly must be replaced. To check for warpage, lay a straight edge across manifold ports. If warped , then machine flat or replace.

2. Remove excessive carbon deposits with a scraper and wire brush.

3. Manifold gaskets must be in good condition to prevent entry of dirt, and to maintain correct fuel-air ratio of intake mixture.

D. INSTALLATION

1. Install new gaskets and retainers on manifold ports.

2. Position manifold assembly on the mounting studs, and install washers and lock nuts. Torque to 25-30 lb.ft.

3. Replace carburetor gasket, and install carburetor; connect fuel line, governor control rod, choke control cable, and accelerator linkage. (Guard against altering any linkage adjustments during removal/installation.)

4. Install elbow in manifold and connect hoses and PCV valve to elbow.

5. Connect exhaust pipe to exhaust manifold flange, using new gasket, and replace carburetor air cleaner hose.

6. Install air cleaner, seat assembly and hood.

7. Open fuel shut-off valve and start engine.

8. Check for noisy or hissing leaks at all manifold flanges.

9. Establish cause of leak, if any, and repair.

TOPIC 4. VALVES-INTAKE AND EXHAUST

A. GENERAL

Valves require grinding at various intervals during the engine service life. These intervals cannot be exactly specified because many variable factors are involved, often without the operator's knowledge. Of these factors, the following have been found, to a greater or lesser degree, to cause reduced valve life:

1. Fuels that break down to form deposits that impair seat contact and prevent heat induction.
2. Deposits from either fuels or oils that accumulate on the valve stems, and cause burning and sticking.
3. Oil not reaching valve guides due to dirt or sludge.
4. Shutting down a hot engine without idling for a few minutes. Exhaust valves that happen to be off the seat when the engine stops may warp; so that, burning occurs on restarting.
5. Tappet clearances not correctly maintained.
6. Lean mixtures due to incorrect carburetor or incorrect carburetor adjustments.
7. Pre-ignition due to incorrect timing, wrong plugs, carbon deposits, or excessive operating temperatures.

B. CHECKING COMPRESSION

A compression check is the best method of determining whether or not valves need grinding. Since different pistons will develop different cranking compression pressures due to compression ratio variations, no specific figures can be given for this test. Most significantly, the pressures in all the cylinders must be within a 10 p.s.i. variance. If it is felt that compression is leaking past the piston rings, inject some heavy engine oil through the spark plug hole before making the test. This will temporarily seal the rings. In addition, a quick knowledge of valve condition may be gained by listening at the carburetor entrance (remove air cleaner connection) and the exhaust outlet while the engine is cranked over. Piston ring blow-by may be heard at the oil filler opening as the pistons are slowly brought into compression and the air allowed to seep past. If valves are leaking badly, the piston ring leakage may not be noticeable. Another indication of leaking valves is an unsteady vacuum reading, particularly at idling speed.

C. REMOVING VALVES

The cylinder head as well as the valve tappet cover must be removed to gain access to the valves and valve springs. The end of each valve stem is fitted with a shallow steel retainer that surrounds the end of the valve spring, and is held to the stem by a pair of wedge keepers or retainers. These retainers must be removed before the valve can be removed.

With a valve spring lifter (Figure 4-1) compress the springs and remove the locks or pins from the valve stems which are in a closed position. Close the other valves by rotating the crankshaft and remove the locks (or pins) from these valves in the same manner. Remove all valves and place them in order, in a rack with holes numbered for both intake and exhaust valves, so they will be reinstalled in their original positions.

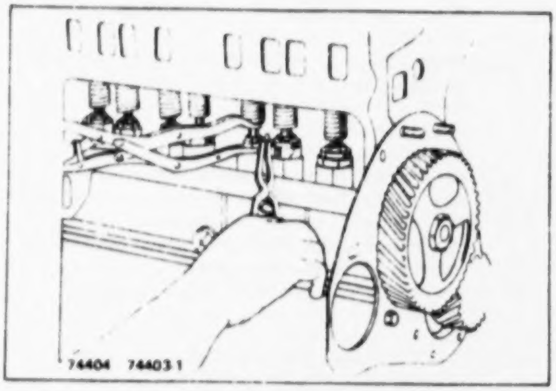


Figure 4.1 Valve Removal

D. SERVICING OF VALVES AND COMPONENTS

Upon removing each valve, examine it carefully. Remove all carbon and burned oil, and check the valve stem and its fit in the guide. Excessive wear in either the stem or guide will make it impossible to secure a tight seat by grinding, unless the valve or guide, and possibly both, are replaced. Check valves and seats for excessive burning, cracks or pitting. Check the valve guides by inserting a valve and noting the amount of side play. Worn valve guides should be replaced. Refer to following subparagraph 1. Valve Guides.

Whenever the valve chamber cover is removed, the valve and spring mechanism should be examined for evidence of inadequate lubrication due to sludging. Excessive sludge in the valve spring area is an indication of too low oil operating temperature, poor filtering action, or an oil that breaks down and is unsuited for the operation involved.

Carefully inspect the crankcase for cracks around the exhaust valve areas.

Inspect spring coils for bright spots that may be an indication of spring weakness when found beyond the closely spaced dampening coils at the spring ends. Over-speeding the engine can cause this condition. Replace any rusted, weak, cracked or broken springs.

Check the tension of each valve spring with a spring scale designed for the purpose. Refer to following subparagraph 5. Valve Springs.

1. Valve Guides

   Clean the valve stem guides, removing lacquer or other deposits by running a valve guide cleaner or wire brush through the guides.

   Check guides for wear by using a "Go and No-Go" plug gage, or a telescope gage and a 1" micrometer. Replace all guides that are worn bell-mouthed and have increased .0015" in diameter. Refer to TOPIC 1. FITS AND TOLERANCES for maximum diameter permissible, to determine actual amount the diameter has increased. When necessary, remove all valve guides; use an arbor press and press them out from the combustion chamber side with a driver slightly smaller than the O.D. of the valve guide.

   Valve guides are a press fit, and service guides are especially machined to press in place and give correct stem clearance without further machining. However, the valve seat MUST be re-cut concentric with the new guide whenever new guides are installed.

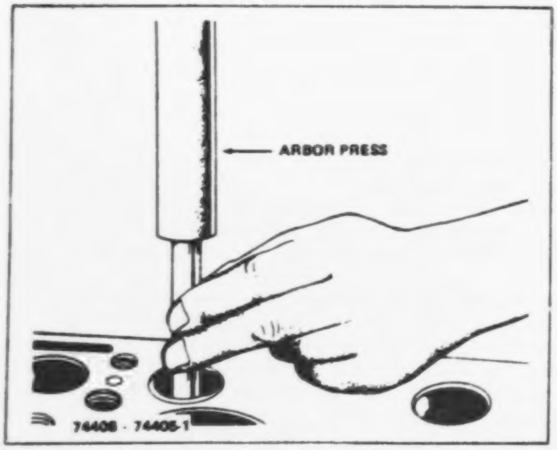


Figure 4-2. Removing Valve Guides

Replace worn guides as required by using a suitable driver and an arbor press from the combustion side to the correct depth below the valve seat. Refer to Figure 4-3 and TOPIC 1. FITS AND TOLERANCES.

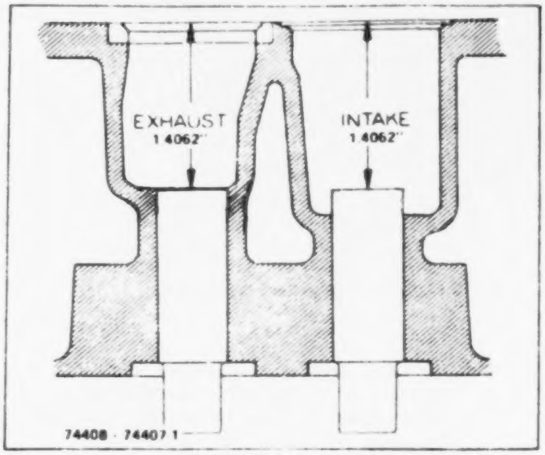


Figure 4-3. Distance from Block Face to Top of Valve Guide

> CAUTION: When replacing guides that are ferrox coated, do not ream, since these are all pre-reamed before being ferrox coated - any further reaming will remove the coating.

2. Valve Seat Inserts

   The exhaust valve seat insert is held in place by a shrink fit.

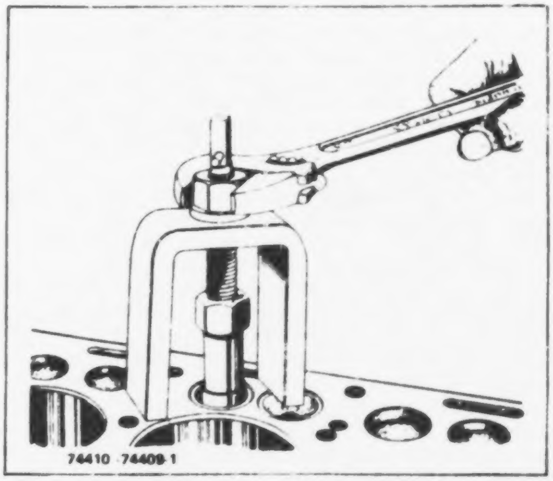


Figure 4-4. Removing Exhaust Valve Seat Insert

Inspect all exhaust valve inserts in the block and replace any that are loose, cracked or otherwise damaged. Use puller for removing faulty insert as shown in Figure 4-4.

When required to replace with new insert, clean and counterbore for .010" larger insert using counterbore tool with correct fitting pilot.

When machining the counterbore, be sure to go deep enough with the tool to clean up the bottom; so that, the insert will have full contact to carry away the heat.

It is not recommended to install new inserts having the same outside diameter as the one removed. Refer to Dimensions of Standard Inserts and Counterbores shown in Figure 4-5.

A - O.D. of Insert.. 1.3485"-1.3475"
B - I.D. of
Counterbore..... 1.3445"-1.3435"
Press Fit........... .003"-.005"

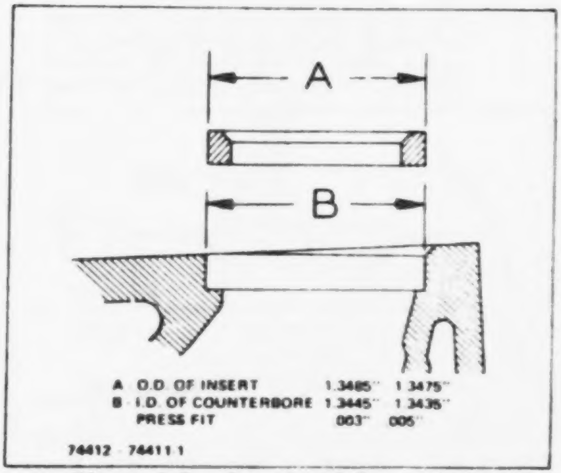

A
B
A O.D. OF INSERT 1.3485" 1.3475"
B I.D. OF COUNTERBORE 1.3445" 1.3435"
PRESS FIT .003" .005"
74412 74411 1

Figure 4-5. Insert and Counterbore Dimensions

When OVERSIZE inserts are used, dimensions of the insert and counterbore increase proportionately .010" to .020" - depending on the oversize.

New insert installation should have a press fit. Chill insert in container with dry ice for 20 minutes before assembling.

Insert may then be installed in the counterbore using a piloted driver, tapping in place with very light hammer blows, without the possibility of shearing the side walls (Figure 4-6). This assures that the insert is seated firmly on the bottom of the counterbore.

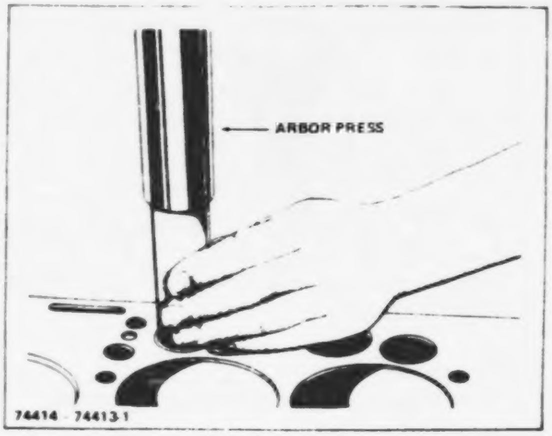


Figure 4-6. Installing Valve Seat Insert with an Arbor Press

3. Valve Seat Grinding

Grind the intake and exhaust valve seats in the block (Figure 4-7) in accordance with specified dimensions in TOPIC 1. FITS AND TOLERANCES. Before removing the arbor, indicate the seat. Total indicator reading of the run-out must not be more than .002". Use a pilot having a solid stem with a long taper, as all valve seats must be ground concentric and square with either new or worn valve stem guide holes (Figure 4-8).

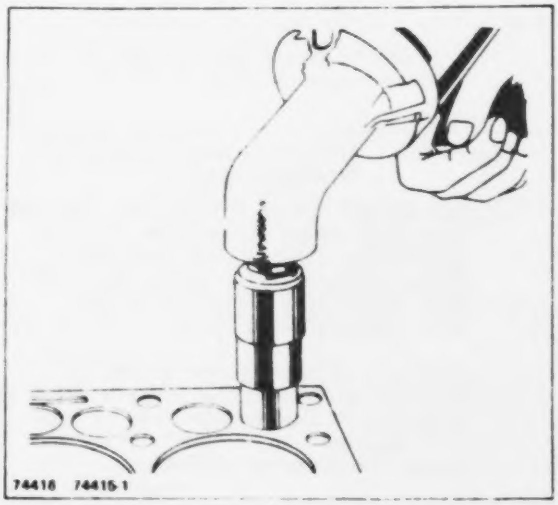


Figure 4-7. Grinding Valve Seat

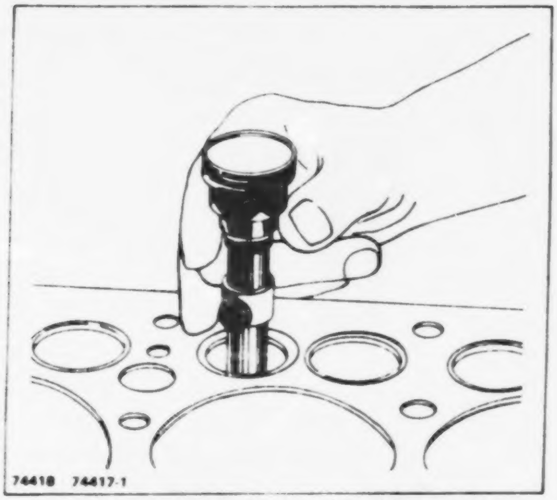
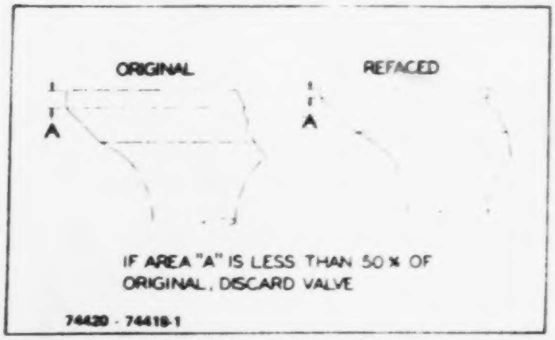


Figure 4-8. Indicating Valve Seat

4. Valves

Inspect valves for condition and replace any that are "necked", cracked or burned, also any on which valve stems are bent or worn more than .002" over the maximum allowable limits. Reface or replace all valves.



IF AREA "A" IS LESS THAN 50% OF ORIGINAL, DISCARD VALVE

Figure 4-9. Allowable Head Thickness of Refaced Valves

Replace all valves having less than 50% margin thickness (outer edge of valve head) after refacing has been completed. To check this dimension, compare the refaced valve with a new valve **(Figure 4-9)**.

Check all refaced or new valves in **V-blocks with indicator (Figure 4-10)** to determine if the contact face is true with the stem within .002". If not, repeat the refacing operation.

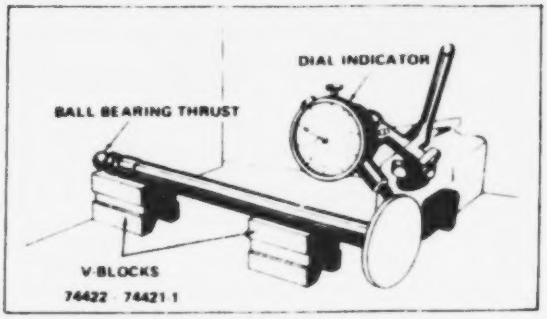


Figure 4-10. Checking Valve Face in "V" Blocks

After the valves and seats have been refaced and reground, coat the seat lightly with Prussian blue and drop the valve into position, oscillating it slightly to transfer the blue pattern to the valve face. This should show a contact width of .0625" to .0938", and should fall well within the width of the valve face, leaving at least .0625" on either side where the blue does not show. If the contact is over .0938" wide, the seat in the head may be narrowed by using a 15° stone to reduce the outside diameter, or using a 60° or 75° stone to increase the inside diameter **(Figure 4-11 and 4-12)**.

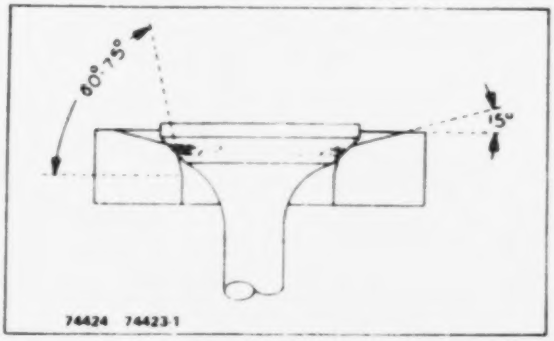


Figure 4-11. Method of Narrowing Valve Seats

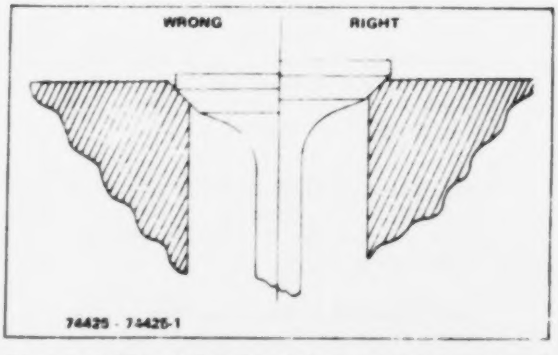


Figure 4-12. Valve Position in Cylinder Block

CAUTION: Never allow valves to set down inside the seat.

After the narrowed-down seat is brought within specifications, the seat should be retouched lightly with the original stone to remove burrs or feathered edge.

"A poor valve grinding job cannot be corrected by valve lapping."

Coat the valve stem with a light film of engine oil.

5. Valve Springs

Check all valve springs on a spring tester (Figure 4-13) to make sure they meet specifications regarding weight and length. When compressed to the "valve open" or "valve closed" length, new springs must fall within specifications. Refer to TOPIC 1. FITS AND TOLERANCES. Used springs showing more than 10% loss must be replaced.

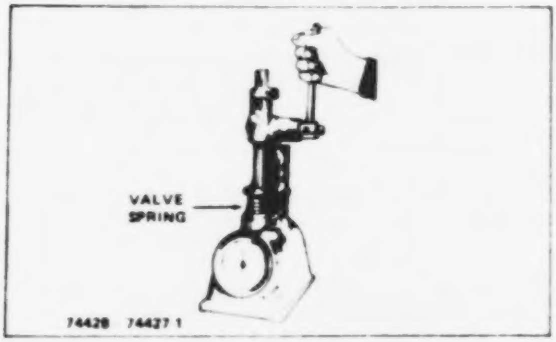


Figure 4-13. Valve Spring Tester

Reassemble the valves and springs in the block with the retainer and retainer lock.

6. Valve Tappets

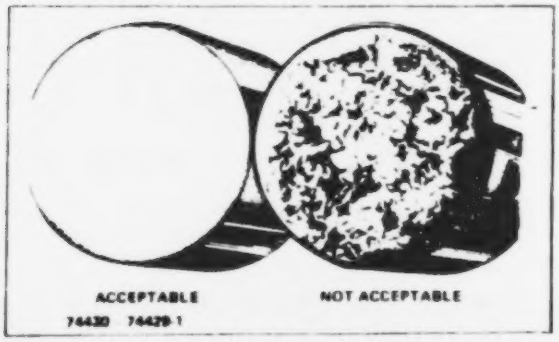


Figure 4-14. Valve Tappet Wear Comparison

Inspect each tappet carefully. A slightly pitted contact face is acceptable; more than that calls for replacement of the tappet. See Figure 4-14.

Check the tappet outside diameter with micrometers to determine if replacement is necessary because of wear.

The tappets ride in a tappet bore in the cylinder block. The tappet bore may be reamed oversize, and oversize tappets installed. Oversize tappets are available as required.

The following specifications apply:

Tappet Outside Diameter...	.9990"
Bore in Block Diameter....	1.0000"
Total Maximum Wear Limit............	.0050"

E. VALVE/VALVE TAPPET CLEARANCE ADJUSTMENT

Accurate valve clearance settings materially prolong engine life and aid performance. Excessive clearances are detrimental to cams and tappets as well as to the rest of the mechanism. On the other hand, when clearances are too low, timing is again disturbed, and the possibility of burned valves becomes much greater.

Valve tappet clearances should be as follows (See Figure 4-15):

Intake	.012"
Exhaust	.020"

To adjust tappet clearances proceed as follows (See Figure 4-16):

1. Disconnect the high tension coil wire to prevent accidental starting of the engine.

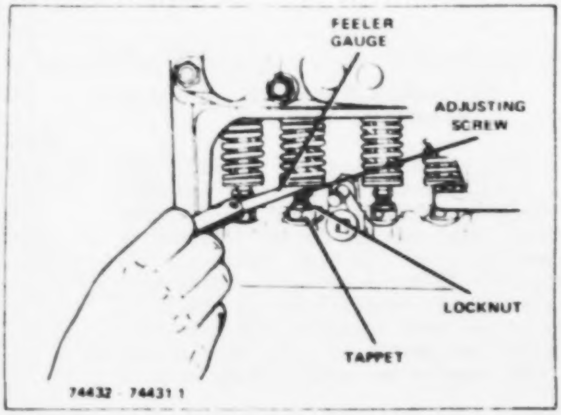


Figure 4-15. Checking Tappet Clearance - Engine at Room Temperature.

2. Remove valve tappet cover from left side of engine. This includes disconnecting and removing fuel pump with front cover.

3. Remove the spark plug from No. 1 cylinder.

4. Place thumb over the spark plug opening and slowly crank the engine until an outward pressure can be felt. Pressure indicates No. 1 piston is moving toward top dead center of the compression stroke. Continue cranking until the timing mark on the flywheel is in center of opening in flywheel housing. Both valves are then closed on the compression stroke of No. 1 cylinder.

5. Use two thin open end wrenches when making adjustment. The lower wrench is used to raise or lower the tappet adjusting screw after the locknut has been loosened. Never attempt to adjust without first loosening the adjusting screw locknut. The feeler gauge should pass between the valve stem and tappet adjusting screw with a slight drag when the valve lash is properly adjusted.

6. Crank the engine one-half revolution at a time, and check the clearance of each valve; adjust if necessary. Do this on each set of cylinder valves in succession, according to the firing order of the engine: 1-3-4-2.

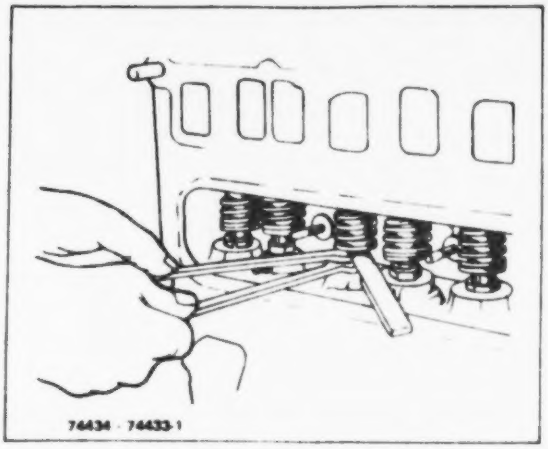


Figure 4-16. Adjusting Valve Tappet Clearance

7. Replace the valve tappet cover and other removed parts. Make sure cover makes an oil-tight seal with the crankcase. Replace gasket.

8. Replace the spark plug and coil wire.

TOPIC 6. CYLINDER HEAD

A. DESCRIPTION

The cylinder head is an alloy cast iron unit, secured to the engine block with special hardened studs and capscrews. The head seals the top end of the cylinders to form the combustion chambers and passages for the intake of the air-fuel mixture, and the expulsion of exhaust gases, as well as cored passages through which the coolant flows to prevent overheating.

B. REMOVAL

1. Drain water from block by opening water drain cock.
2. Drain radiator.
3. Loosen clamps on upper radiator hose and remove hose, taking care not to damage thermostat located at cylinder head end of hose.
4. Disconnect water bypass tube from water pump.
5. Disconnect wire from water temperature sender.
6. Disconnect spark plug ignition cables from spark plugs, and identify each cable.
7. Remove spark plugs, and cap or tape exposed ports.
8. Remove capscrew or nut holding distributor clamp to cylinder head. Remove distributor.
9. Refer to TOPIC 3 and remove the manifold.
10. Remove cylinder head mounting capscrews and stud nuts.
11. Lift the cylinder head and gasket off the engine and place it on a work bench.
12. With a clean, dry cloth wipe all exposed engine internal areas free of water and place a protective cover, such as a plastic sheet, over exposed cylinders.

C. SERVICING

1. Using a scraper and wire brush, remove all carbon from combustion areas. See Figure 5-1.
2. Clean the cylinder head thoroughly with an acceptable cleaning solvent and dry thoroughly with compressed air.

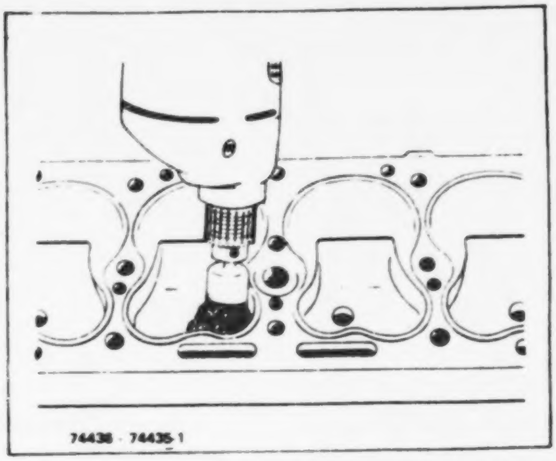


Figure 5-1. Cleaning Carbon from Combustion Chamber

3. Make sure that gasket contact surfaces on the head are clean, smooth and flat.
4. Inspect cylinder head for cracks, holes and warpage. Replace damaged heads.

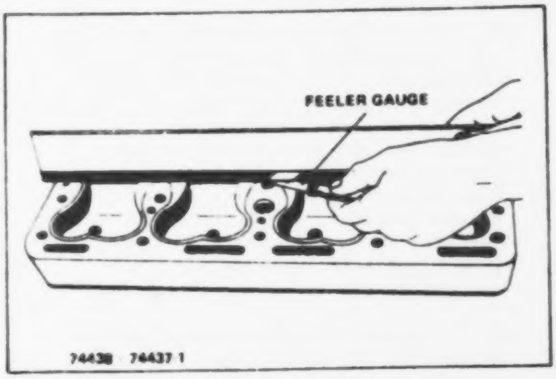


Figure 5-2. Checking Cylinder Head Flatness Lengthwise

5. Check out-of-flatness with straight edge and feeler gauge: maximum permissible is .00075" per inch of width or length (Figures 5-2 and 5-3). Thus, for a cylinder head 16" long, maximum permissible lengthwise out-of-flatness is .012". Out-of-flatness should vary gradually and uniformly from end to end and side to side. Localized depressions or high spots should not exceed .003".

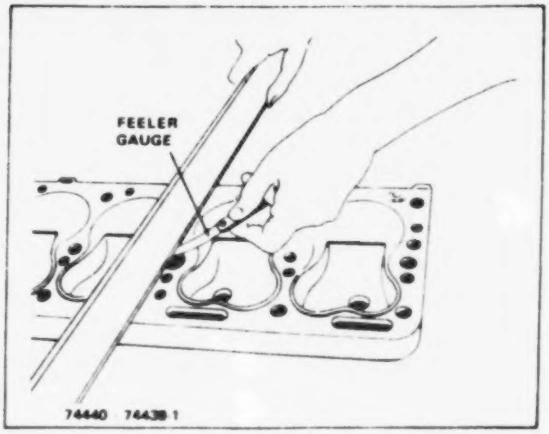


Figure 5-3. Checking Cylinder Head Flatness Crosswise

D. INSTALLATION

1. Install new head gasket and replace cylinder head on cylinder block.

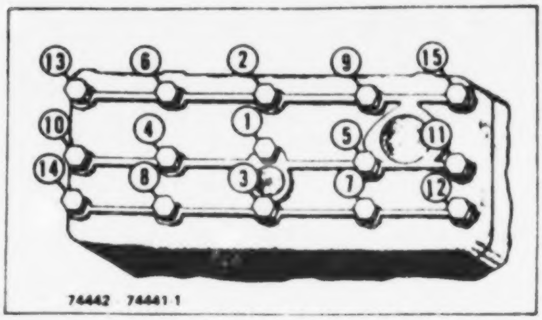


Figure 5-4. Cylinder Head Torquing Sequence

2. Refer to Figure 5-4 for correct cylinder head capscrew torquing sequence. Install two 4908605-1 capscrews at locations 6 and 12. All other capscrews are identical.

> NOTE: Capscrews should be tightened in successive stages and in such order as will ensure even pressure over the entire surface of the cylinder head and gasket. If all the outside capscrews are pulled up first, instead of the center ones, the head will be cocked and the gasket will not fit tight enough to prevent burning or blowing out between cylinders. A good torque wrench is recommended for this purpose. It is good practice to hold tension on each capscrew for a few seconds before releasing the wrench.
>
> It is recommended that several passes be made in tightening down the head so as to avoid any warpage. At the first pass apply approximately one-half of the recommended torque, and then increase the torque one-half each succeeding pass until the recommended torque is attained. Torque all capscrews to 70-75 lb.ft.

3. Install distributor and secure it with clamp and capscrew.

4. Remove covering from spark plug ports and, after checking the insulation for cracks and verifying correct gap, re-install spark plugs.

5. Attach respective spark plug ignition wiring to plug caps.

6. Connect temperature sender wire.

7. Secure water by-pass tube to water pump. Do not over-tighten connector.

8. Re-install upper radiator hose, thermostat and attaching clamps.

9. **Refer to TOPIC 3 and install the manifold.**

10. Add engine oil, allowing for extra half-quart if oil filter was changed.

11. Close radiator and cylinder block water drain cocks.

12. Refill radiator.

13. Refer to TOPIC 16. ENGINE RUN-IN SCHEDULE for compression check.

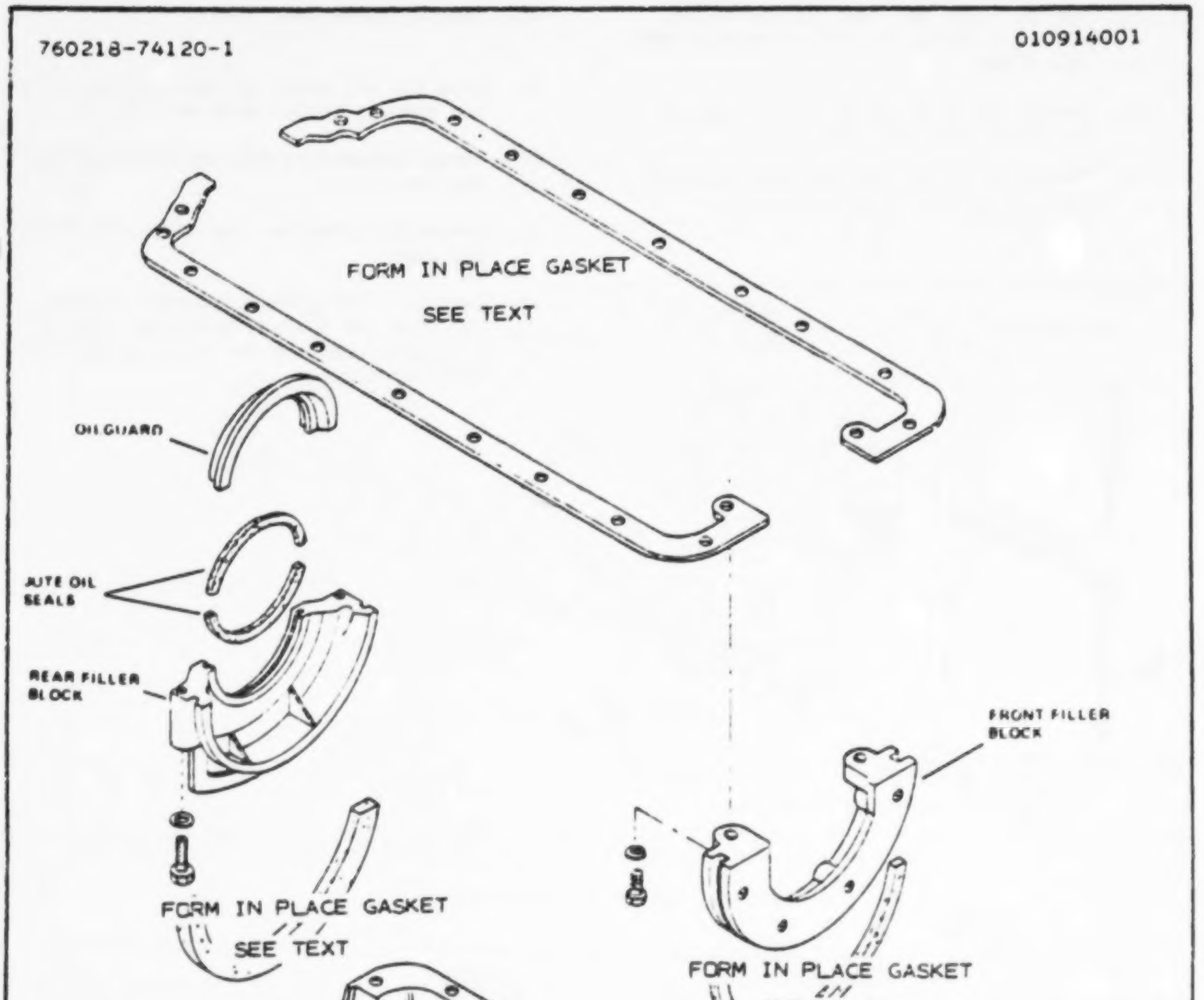

760218-74120-1
010914001
FORM IN PLACE GASKET
SEE TEXT
OIL GUARD
JUTE OIL SEALS
REAR FILLER BLOCK
FRONT FILLER BLOCK
FORM IN PLACE GASKET
SEE TEXT
FORM IN PLACE GASKET
SEE TEXT
2
OIL DRAIN PLUG

Figure 6-1. Oil Pan Assembly

22. Remove front and rear filler blocks. Refer to TOPIC 14. FILLER BLOCKS AND OIL GUARD.

23. Remove fan drive pulley, drive adapter and shaft from gear cover.

24. Remove retaining ring and pump coupling. Pull timing gear from crankshaft (Figure 23).

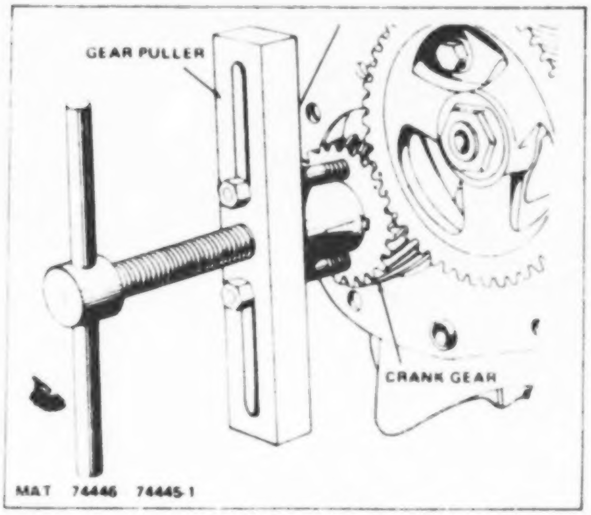

GEAR PULLER
CRANK GEAR
MAT 74446 74445-1

Figure 23. Removing Crank Gear

25. Remove timing gear cover.

26. Drop the oil pump, by removing nut holding pump to center main bearing cap.

27. Remove connecting rod cap nuts and bearing caps.

28. Remove main bearing cap bolts and bearing caps.

29. Carefully lift the crankshaft (Figure 24) from the bearing mountings. Avoid nicking or bumping the bearing surfaces while handling.

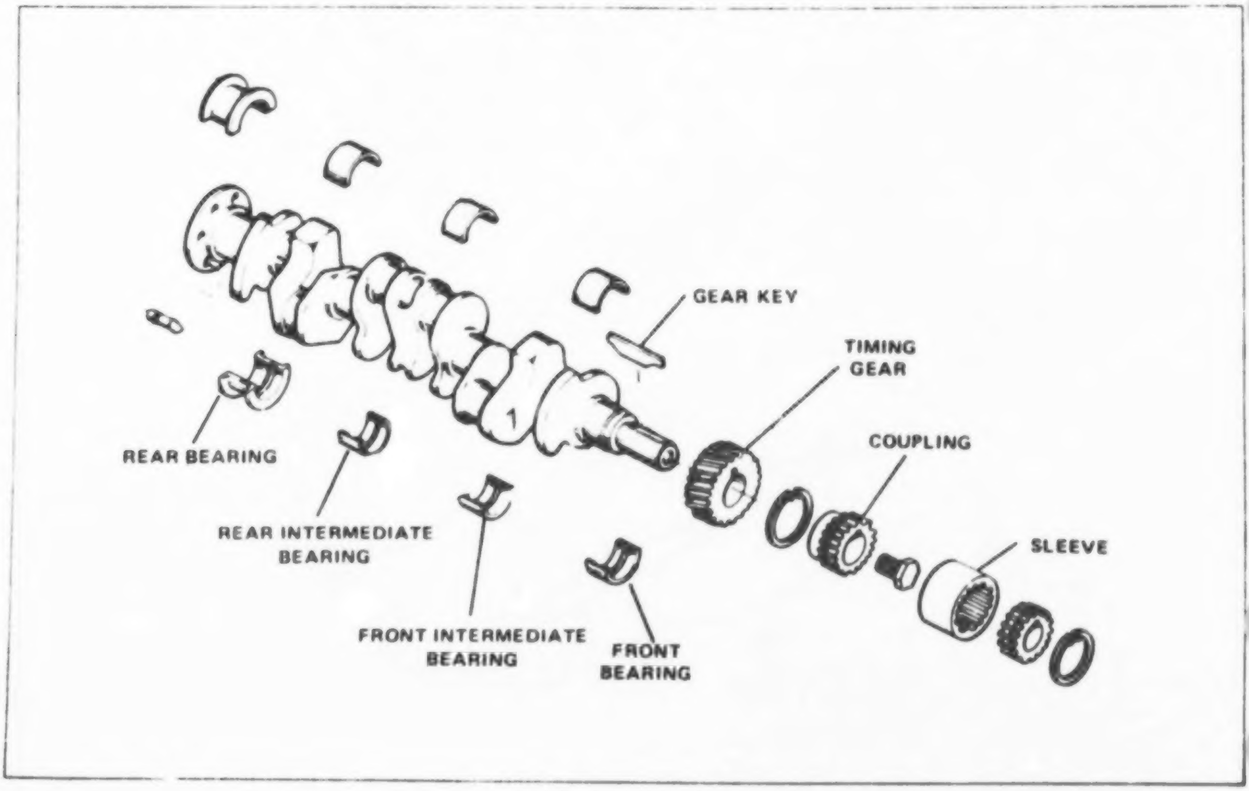

GEAR KEY
TIMING GEAR
COUPLING
SLEEVE
REAR BEARING
REAR INTERMEDIATE BEARING
FRONT INTERMEDIATE BEARING
FRONT BEARING
1

Figure 24. Crankshaft Assembly

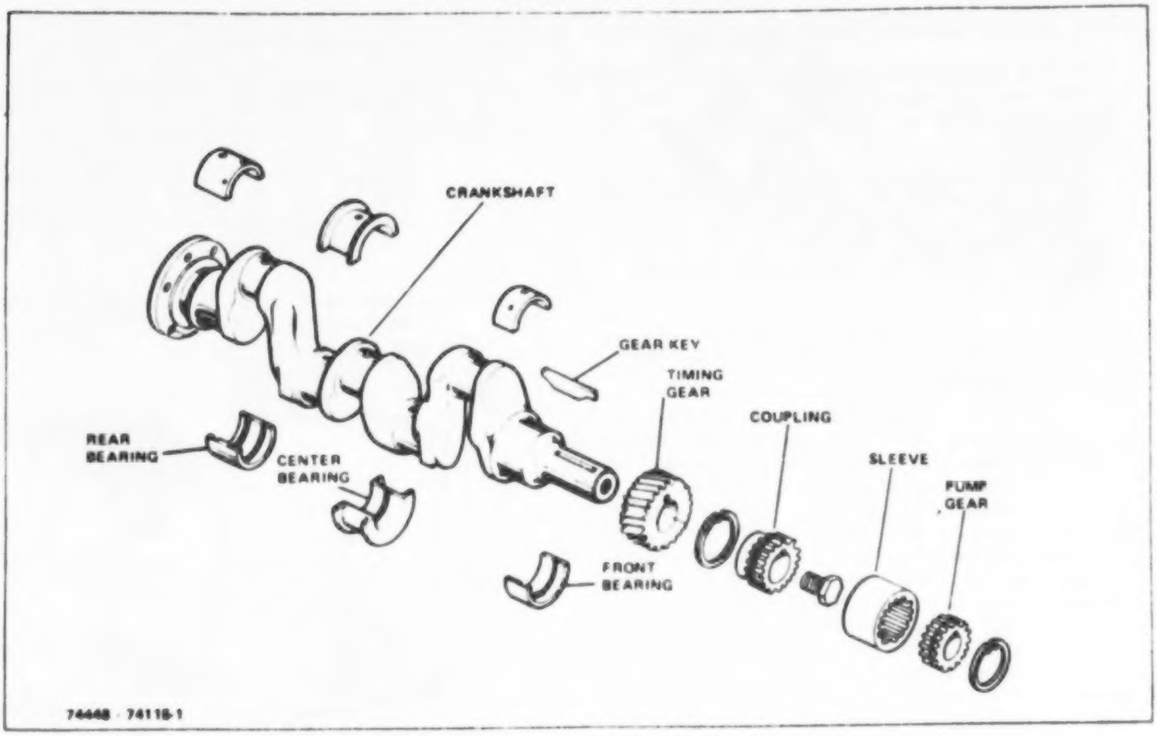

CRANKSHAFT
GEAR KEY
TIMING GEAR
COUPLING
SLEEVE
PUMP GEAR
REAR BEARING
CENTER BEARING
FRONT BEARING
74448 · 74118-1

Figure 6-2. Crankshaft Assembly

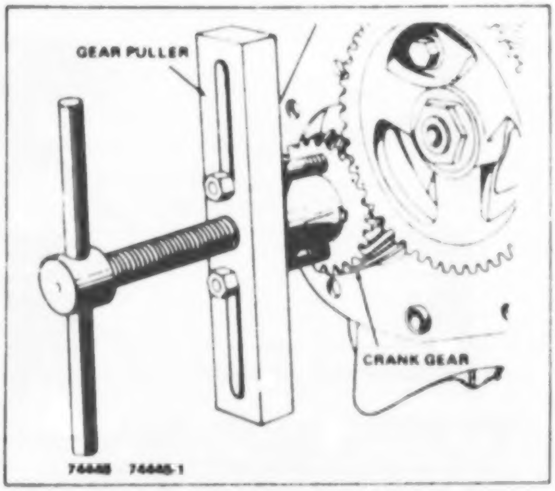

GEAR PULLER
CRANK GEAR
74448 74445-1

Figure 6-3. Removing Crank Gear (Typical)

C. CRANKSHAFT INSPECTION AND SERVICING

Check for run-out by mounting the crankshaft in 'V' blocks at the front and rear main bearing journals. Insert oil-soaked paper strips in the 'V' blocks to avoid marring the shaft. The dial indicator reading should be taken at the center main bearing journal.

The run-out, or total variation in the indicator reading during one complete revolution of the crankshaft, is limited to .002". Straighten crankshaft, if necessary, to be within .002" reading.

Check the connecting rod and main bearing

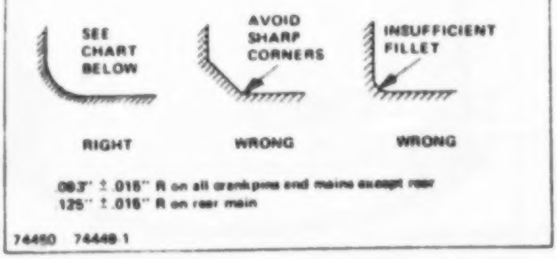

SEE CHART BELOW
AVOID SHARP CORNERS
INSUFFICIENT FILLET
RIGHT
WRONG
WRONG
.093" ± .015" R on all crankpins and mains except rear
.125" ± .015" R on rear main
74450 74449-1

Figure 6-4. Crankshaft Fillet Radii

journals for out-of-round and tapered condition. The limit is .0005".

If the crankshaft is scored, or worn enough so that new bearings will not fit with the required clearance, the crankshaft should be reground.

Standard crankshafts may be reground to decrease the diameter a maximum of .040". When reground, the fillet radii must be within dimensional limits and must be perfectly blended into thrust and bearing surfaces (Figure 6-4).

D. BEARING INSPECTION AND INSTALLATION

1. General

Both the connecting rod and main bearings are of the steel-backed, precision type. Due to the close machining of this type of bearing, no fitting, filing, scraping, boring or other adjustment is required or permissible. Replacement must be in complete bearing units. Never replace only one-half of a bearing. Service bearings are available in .010", .020", and .040" undersize for use on reground crankshafts. Never attempt to adjust a bearing by filing, grinding, or lapping the bearing cap. The bearing seats are precision ground with the caps in place. Any metal removed from either side prevents the proper fit of a connecting rod bearing in the rod, and in the case of a crankcase, makes the entire crankcase unsuited for further use.

2. Bearing Inspection

NOTE: Inspect the bearing shells and crankshaft journals. If there is any indication of distortion, scoring or actual wear, the bearing shells must be replaced.

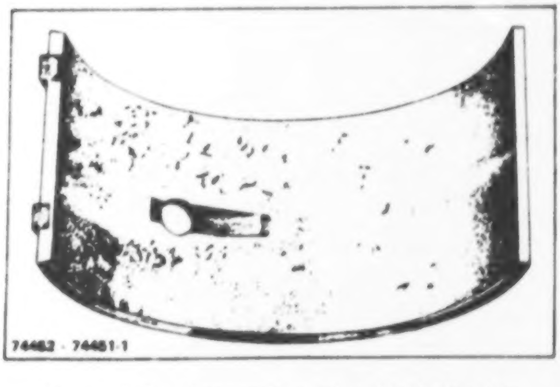


Figure 6-5. Appearance of a Good Bearing.

Some models use tri-metal bearings which, when new, are smooth and highly polished. However, a very few hours of operation will change their appearance completely. The bearing surface becomes a leaden gray in color and develops minute craters, almost cellular in appearance **(Figure 6-5) which follow the pattern of** the matrix. This appearance is a natural characteristic of this type bearing and in no way indicates failure.

Refer to Figures 6-6 and 6-7 for the appearance of corrosion and scoring damage to bearings.

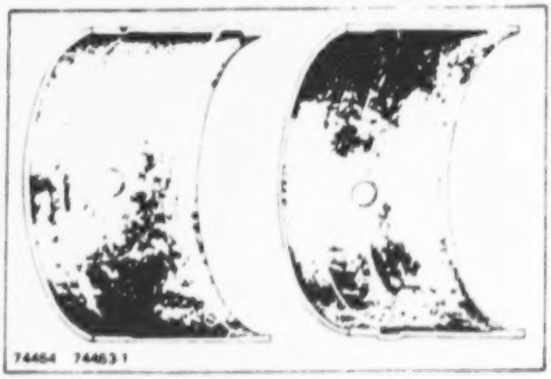


Figure 6-6. Bearing Damage Due to Corrosion

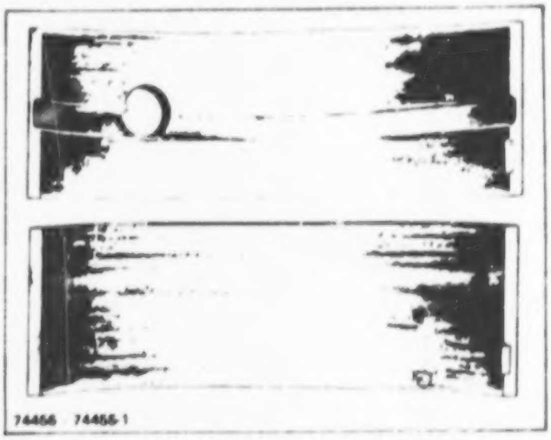


Figure 6-7. Scored Bearing Due to Dirt of Lack of Lubrication

If the visual inspection appears satisfactory, bearings should be removed and checked for thickness using a ball micrometer.

To remove the upper half of the bearing shell use a special tool obtainable at most parts houses, which is a pin with an angular head (Figure 6-8). This tool may be inserted in the oil hole of the crankshaft and, as the crankshaft is turned in a clockwise direction, the head of the pin picks up the bearing shell and forces it out of the bore in the block.

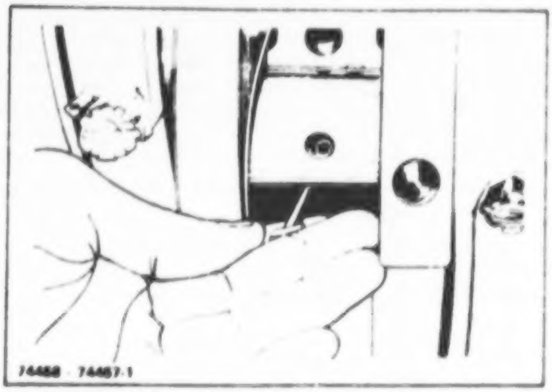


Figure 6-8. Removing Upper Half of Main Bearing Shell

The thickness of the bearing shells is given in TOPIC 1. FITS AND TOLERANCES. If this thickness has been reduced more than .0005" beyond the maximum allowable tolerance the bearing shell must be replaced (Figure 6-8).

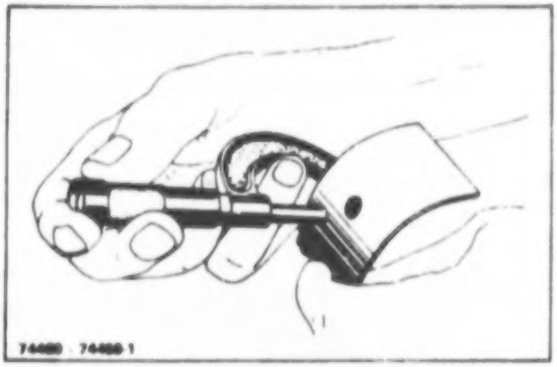


Figure 6-9. Measuring Bearing Thickness

If visual inspection of the crankshaft has shown no indication of excessive wear or scoring, the clearance of the bearings should be checked with feeler stock.

Check each bearing, one at a time, by using a piece of Plastigauge of a diameter specified to check certain clearances.

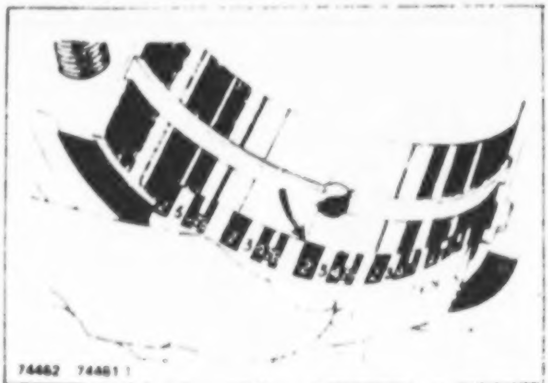


Figure 6-10. Checking Bearing Clearance with Plastigauge

CAUTION: When using this method DO NOT TURN the crankshaft, as that would destroy the Plastigauge.

By placing the Plastigauge in the bearing and tightening it in place, the width of the Plastigauge after crushing determines the bearing clearance, as shown in Figure 6-10.

The term "crush" is generally understood as the projection of the bearing edges above flush with the mating surfaces of the bearing seat and cap. This crushing action forces the bearing halves into close contact with their seats for greater rigidity and good heat conduction.

The correct amount of crush has been allowed during the manufacture of the bearings, and no attention to that detail is necessary at the time of replacement. The use of a torque wrench for tightening bearings is necessary to insure sufficient "crush" on the bearings, to force the shells against the crankcase metal without distortion.

An alternative method (Figure 6-11) is to use a piece of 1/2" feeler stock lengthwise in the bearing shell, on a film of oil. The thickness of the feeler stock should be equivalent to the maximum clearance permissible in the bearing. Assemble the bearing cap and tighten the screws, torquing them to specification, then try to turn the crankshaft by hand to determine whether or not a drag is felt.

If a definite drag is felt and the piece of feeler stock is equivalent to, but

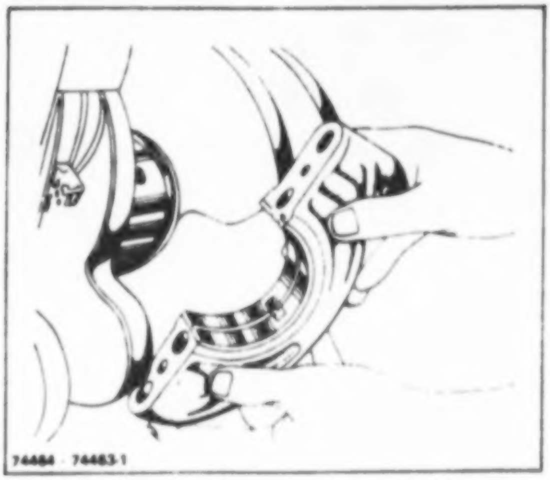


Figure 6-11. Checking Bearing Clearance with Feeler Stock

no more in thickness than, the maximum clearance specified, neither the crankshaft nor the bearing is worn excessively as far as clearance is concerned.

When using new bearings with a crankshaft that is not worn, checking may be done with a piece of feeler stock as outlined above. This should lock up the crankshaft, making it possible to turn only by use of a bar or wrench.

Generally, the test on main bearings consists of tightening each bearing cap in turn, and turning the crankshaft to detect binding.

It is emphasized that any unusual bending or run-out in a crankshaft makes it impossible to fit bearings accurately. For this reason, the time spent in making a run-out check is well worth while. Magnetic inspection of the crankshaft and other stressed parts is also recommended if the proper equipment is available.

Connecting rod bearings and crank pins may be checked in the same manner as main bearings with one exception: do not try to turn the crankshaft when the connecting rod bearing is tightened on it with a piece of feeler gauge assembled; rather, try to move the connecting rod from side to side (Figures **6-12 and 6-13**).

The familiar test of connecting rod bearing clearance consists of manually gripping the rod cap after the bearing bolts are tightened and attempting to move the rod from side to side in the direction of end clearance. If the crank pin is not worn, a well-fit bearing is usually just loose enough to be "snapped" from side to side, without actually feeling so loose as to push easily. Sometimes a slightly snug bearing will not move under pressure but will move readily under light blows from a soft-faced hammer. This condition is usually considered satisfactory, providing the engine is given adequate break-in time.

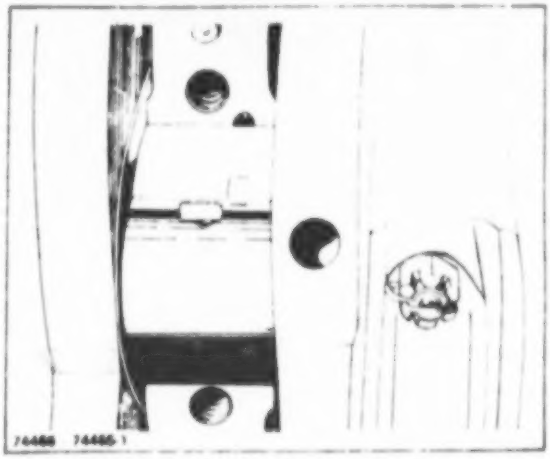


Figure 6-12. Replacing Bearing

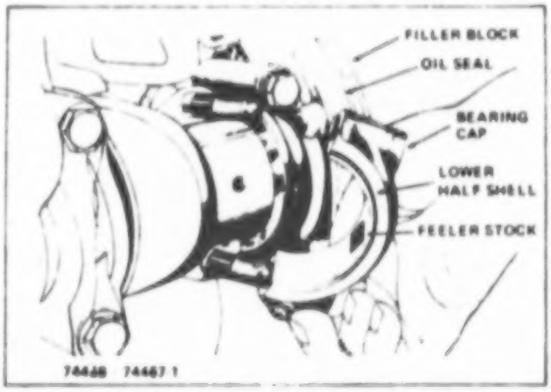


Figure 6-13. Checking Connecting Rod Bearing with Feeler Stock

3. Bearing Installation

NOTE: Coat all running surfaces with clean, fresh engine oil when installing bearings.

Be sure that the bearings seat on absolutely clean surfaces and that the back of each bearing is wiped perfectly clean. The slightest bit of dirt or carbon squeezed between the back of a bearing and its seat can cause rapid bearing failure by developing a localized high spot.

Equally important in obtaining maximum bearing life is the correct tension on the bearing cap nuts. Pull down on all nuts evenly, going from one side of the bearing to the other. Apply final tension with a torque wrench using a slow steady pull and holding the wrench "on torque" for a few seconds when the proper value is reached.

Main bearings should be torqued to 85-95 lb ft, and connecting rod bearings should be torqued to 40-45 lb.ft.

It is preferable to go to a slightly higher tension if necessary. If it is apparent that the cotter pin cannot be installed without bringing the tension dangerously near the limit of the bolt, remove the nut and try again with another nut at the same location. Previous over-torquing, or some other damage to the bolt or nut is sometimes encountered and will be felt by the torque "softening up" so that the nut can be turned without any appreciable increase in wrench tension. Never allow a bolt or a nut in this condition to remain in the engine.

E. CRANKSHAFT INSTALLATION

1. Carefully install oil guard in crankcase, and install crankshaft in bearing mountings; secure main bearing caps and cap bolts. Torque to 85-95 lb.ft. Refer to preceding paragraph D. BEARING INSPECTION AND INSTALLATION in this section.
2. Install connecting rod bearing caps and cap nuts. Torque to 40-45 lb.ft.
3. Install oil pump. Refer to TOPIC 12. OIL PUMP.
4. **Install key and crankshaft gear. Install pump coupling (Figure 6-2) on crankshaft. Tighten capscrew to 140-150 lb. ft. Refer to TOPIC 10, GEAR TRAIN for timing mark alignment. Use a driving sleeve to tap gear snugly into place. Hard driving is not necessary and indicates the gear is cocked on the shaft.**
5. Install timing gear cover; inspect seal and replace if necessary. Gasket between cover and engine block should always be replaced.
6. Loosely bolt timing gear cover to engine block.
7. **Install pump sleeve and pump gear (Figure 6-2).**
8. **Refer to TOPIC 18 or 19 and install governor. Install fan drive shaft and gear, drive adapter and pulley on gear cover. Tighten cover bolts.**
9. Replace front and rear filler blocks. Refer to TOPIC 14. FILLER BLOCKS AND OIL GUARD.
10. Replace oil pan and change gaskets. Secure oil pan capscrews.
11. Replace flywheel housing and secure bolts.
12. Replace flywheel, ensuring the same bolts removed are re-installed. Torque bolts to 35-40 lb.ft.
13. Rotate engine to upright position and re-install transmission.
14. Install engine/transmission and secure engine to motor mounts.
15. Reconnect transmission linkage oil lines and drive shaft.
16. Connect engine oil filter lines.
17. Install intake/exhaust manifold, - use new gasket.
18. Reconnect governor rod assembly, carburetor linkage, fuel line and air hose.
19. Install starter motor.
20. **Connect wires to temperature and oil pressure senders and neutral start switch.**
21. Remove covering from spark plug ports, and after verifying proper spark gap reinstall spark plugs.
22. Replace distributor, and spark plug ignition wiring. Hook up spark plug wiring to respective plugs.
23. Replace alternator.
24. Install water pump.

25. **Install hydraulic pump and connect tube and hose to pump and reservoir.**

26. Install and secure fan blade.

27. **Adjust alternator strap for approved** fan belt tension and lock - (1/2" depression @ 10 lbs. of force).

28. Reconnect and tighten water bypass tube.

29. Reconnect upper and lower radiator hoses. Secure both with respective hose clamps. Connect transmission oil cooler lines.

30. Ensure following conditions exist:

    a. Oil pan drain installed/secure.

    b Engine block pipe-plug installed/tightened.

31. Fill radiator, including anti-freeze, if required.

32. Fill crankcase with recommended engine oil, allowing extra half-quart if oil filter was changed.

33. Start engine, check for proper idle/operation and check for any water, oil or fuel leaks.

34. Turn engine off.

TOPIC 7. FLYWHEEL AND HOUSING

A. DESCRIPTION

The flywheel is a kinetic energy device which is set in motion by the starter motor to initially turn the crankshaft. When the engine starts, the crankshaft drives the flywheel which then employs its kinetic energy to develop torque conversion and smooth rotation required by the transmission.

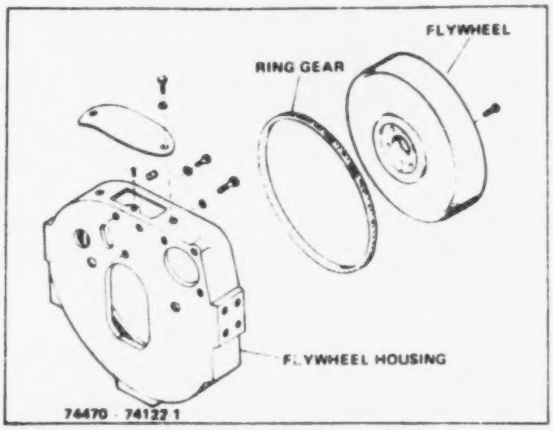


Figure 7-1. Flywheel, Ring Gear, and Flywheel Housing

The flywheel is bolted securely to a flange on the rear end of the crankshaft. One of the capscrew holes is offset and the flywheel can be attached to the crankshaft flange in only one position. The ring gear, which meshes with the starter motor gear, is mounted around the flywheel.

The flywheel housing is bolted to a machined surface of the crankcase, and in its upper outer edge it contains an opening through which the timing (T.D.C.) mark on the flywheel can be observed.

The flywheel is machined and balanced so that the clutch face and locating counterbore run true to its axis. The flywheel and housing seldom need replacement. However, whenever either component part is removed both should be checked for run-out. When runout is not within limits specified in TOPIC 1 FIT AND TOLERANCES, the assembly should be checked to determine the cause and corrected.

B. REMOVAL

1. Flywheel

To service flywheel or flywheel housing, it is necessary to first remove transmission. Refer to REPAIR MANUAL - TRANSMISSIONS.

Remove two capscrews which are opposite each other and install guide studs.

Remove remaining capscrews and slide flywheel off over guide studs.

2. Flywheel Housing

If more than one engine is being rebuilt at a time, the housing should be identified with its original cylinder block and should be reassembled so that it is mounted on the same cylinder block in the rebuilding process.

Loosen capscrews on oil pan to relieve pressure at pan section of oil seal in flywheel housing.

Remove two capscrews opposite each other and install guide studs.

3. Ring Gear

If replacement of ring gear is necessary, remove ring gear from flywheel by grinding a notch through gear at root of one of the teeth, then expand ring and drive it from its position. Do not attempt to remove the ring gear without first expanding it.To expand gear, heat to 475°F.

C. INSPECTION

It is very important that all burrs and nicks be removed from surface of flywheel that fits against flange of crankshaft. If surface is not smooth and true, flywheel may wobble, which will result in improper torque converter operation and engine vibration.

To be sure that the crankshaft flange has not been sprung or otherwise damaged or that the counterbore in the flywheel, which locates it on the crankshaft, is not damaged, mount an indicator on the flywheel housing and check **the flywheel for run-out (Figure 7-2). Maximum** indicated reading must not be more than .008".

CAUTION: When checking run-out remove spark plugs to allow engine to be turned over freely.

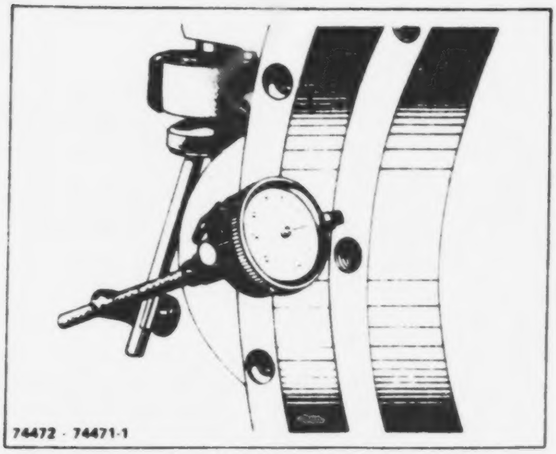


Figure 7-2. Checking Flywheel Run-Out

The indicator should be set up so that it contacts the clutch face or the vertical surface of the clutch counterbore, then turn the flywheel at least one full revolution at the same time holding against the crankshaft to offset the possibility of end play.

Excessive run-out of the flywheel, in either position, is probably caused by dirt in or damage to counterbore locating the flywheel on the crankshaft flange.

Relocate the indicator to check the inside diameter of the counterbore (**Figure 7-3**). Maximum indicator reading must not be more than .008".

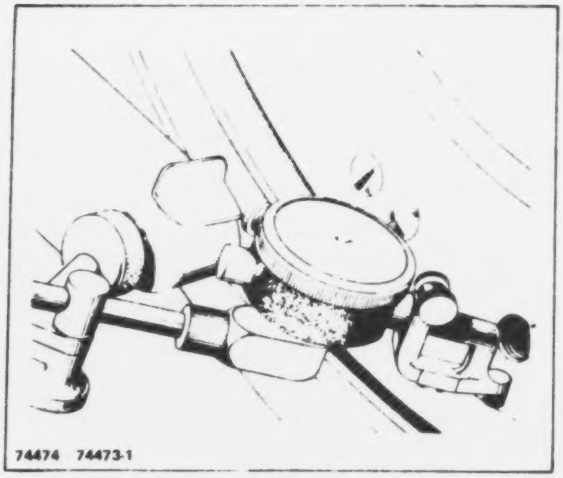


Figure 7-3. Checking Flywheel Counterbore

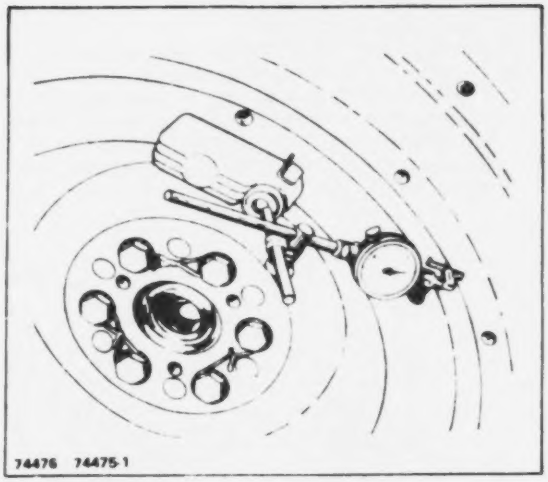


Figure 7-4. Checking Flywheel Housing Face

When assembled, mount the indicator on the flywheel so that it contacts the housing face and turn the crankshaft, at the same time holding against it to counteract end play (Figure **7-4). Maximum indicator reading must not exceed** .008".

Relocate the indicator to contact the housing bore and check this in the same manner (Figure **7-5). The same run-out limits prevail.**

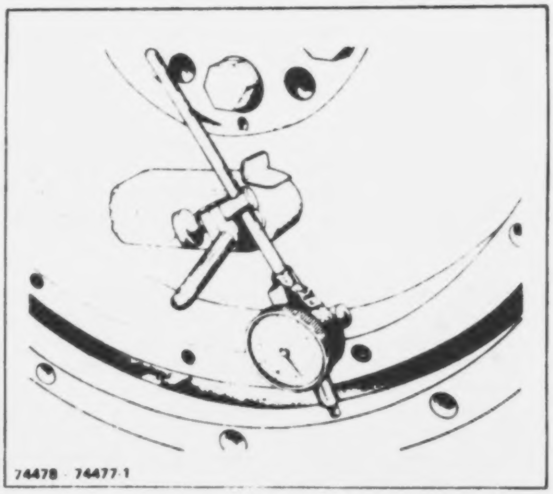


Figure 7-5. Checking Flywheel Housing Bore

D. INSTALLATION

1. Flywheel Housing

Install flywheel housing by sliding housing on studs, making certain mating surfaces of flywheel housing and cylinder block are clean and smooth. Remove studs and secure mounting capscrews.

Before installing starter motor and transmission, it is good practice to dial indicate housing and check for housing run-out. Total run-out should never exceed .008".

2. Ring Gear

The ring gear is uniformly heated to approximately 475°F. (Dark yellow heat visible in the dark) so that it can be shrunk fit on the flywheel which should be at room temperature. Do not heat ring gear to a bright red, since at that excessive temperature the heat treatment given the ring gear at the factory would be destroyed.

After proper heating, start the ring gear on the flywheel so, when installed, the chamfered ends of the teeth engage with the drive pinion of the starter motor. Drive the ring gear down tight against the shoulder of the flywheel. Allow the ring gear to cool slowly. DO NOT cool with water.

3. Flywheel

Prior to installing a new flywheel, check the timing marks on both the old and the new flywheels. Install correct timing mark or plate on flywheel. The flywheel can be installed in only one position because of the offset capscrew hole.

When assembled, mount the indicator on the flywheel so that it contacts the housing face, and turn the crankshaft, at the same time holding against it to counteract end play. The maximum indicator reading must not exceed .008".

Torque as specified in Topic 1, FITS AND TOLERANCES, Paragraph D.

MEMO

TOPIC 8. PISTON AND CONNECTING RODS

A. DESCRIPTION

The pistons used are aluminum and use four rings - two compression rings, one scraper ring and one three-piece oil control ring.

The rifle drilled forged connecting rods are precision ground at the large end to receive precision type thin-wall bearing shells (Figure 8-1). No shims are used, since oversize bearing shells are available to provide a tight fit.

A bronze bushing is burnished and diamond bored in place in the upper end of the connecting rod.

Pistons are available in .010", .020", .030" and .040" oversizes to provide correct tolerances when cylinders are bored and honed due to wear. Piston rings are available in the same oversizes to match specific pistons.

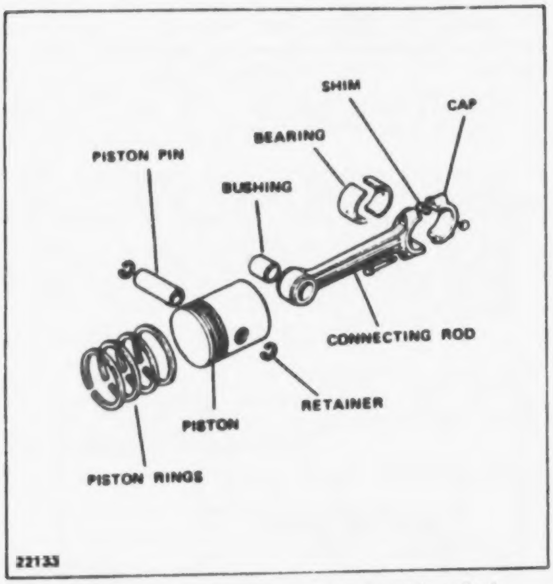


Figure 8-1. Piston and Connecting Rod Assembly

B. REMOVAL

Piston and connecting rod replacement is accomplished with the engine out of the truck. (Refer to TOPIC 6. CRANKSHAFT AND CRANKSHAFT COMPONENTS).

All piston and rod assemblies are removed from the top of the bore. Before removing, however, it is important that the ridge at the top edge of the bore be removed by using a Ridge Cutting tool. If the same bearings are to be reused, be sure the bearing shells are kept in order with respect to which rod they go in, which is top and which is bottom. However, it is usually good practice to replace bearing shells with new ones. Inspect pistons for score marks or for worn, stuck or broken rings. Inspect for excessive carbon deposits on piston walls and in ring grooves. Check ring grooves for excessive wear and worn edges. Check pistons for cracks.

When fitting replacement pistons and rings, four different precision checks should always be made: check ring gap, check ring to land clearances, check pin clearance in piston boss, and check piston skirt clearance.

C. INSPECTION

1. Checking Piston Ring Gap

Check the piston rings in the cylinders for gap. To do this, insert a piston in the cylinder bore in an inverted position and then insert each ring, one at a time, about 2" down in the bore and bring the bottom edge of the piston up against the ring to square it up in the cylinder bore (**Figure 8-2**).

Check the gap between the ends of the ring with a feeler gauge in accordance with specifications shown in TOPIC 1. FITS AND TOLERANCES.

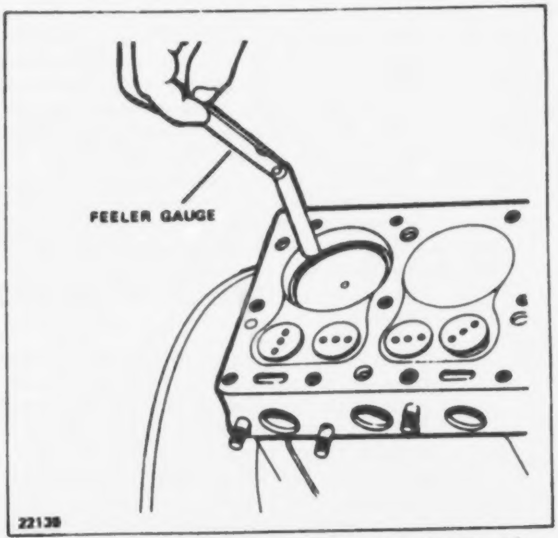


Figure 8-2. Checking Ring Gap (Typical)

Those rings with gaps less than specified should be carefully dressed off with a flat cut file until the correct clearance is obtained. Fairly wide ring gaps, near the top limit, are far less detrimental to engine performance than gaps which are too tight. The two top rings require greater end gap than the lower rings because they are subjected to the most heat and the least lubrication.

2. Checking Ring-to-Land Clearance

Piston ring side clearance must always be checked when fitting rings to pistons which have been in service (Figure 8-3). The object of the check is to spot any pistons in which the ring grooves may have worn excessively wide. A piston in this condition must be replaced.

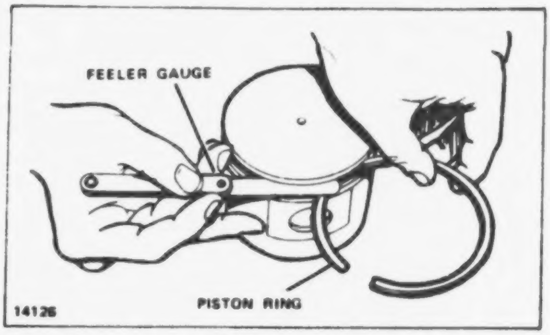


Figure 8-3. Checking Land-to-Ring Clearance

To check the side clearance, select a feeler gauge of the maximum clearance specified. With the ring in place, insert the feeler if possible between the ring land and the ring held well back in the groove. If the feeler slides in at any point, it indicates the clearance is at or over allowable maximum. A snug fit of the feeler suggests further consideration as to whether the piston warrants reinstallation since the groove wear may be at the top limit.

On all pistons passing the above check, make an inspection for minimum clearance with a feeler gauge of the specified minimum thickness. This feeler should slide freely all around the groove as the piston and ring are rotated.

D. CONNECTING RODS AND PISTON RINGS - REMOVAL FROM PISTON

To avoid breaking piston rings, the use of a ring remover and installer is recommended (Figure 8-4). Care must be taken not to overstress piston rings by spreading ends more than is necessary to remove them from piston. Before removing rings, inspect for wear and side clearance in grooves. However, removal will be necessary in order to clean carbon from grooves.

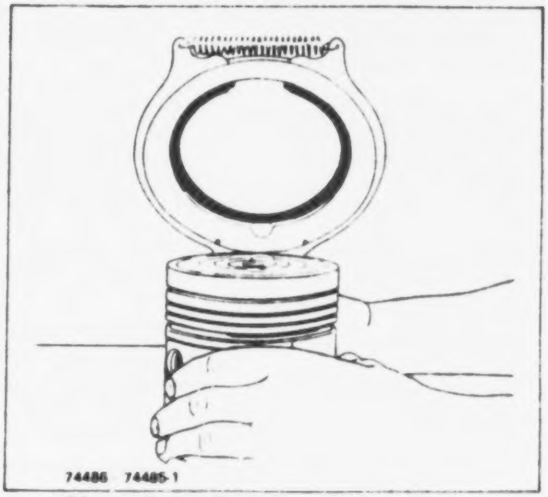


Figure 8-4. Removing or Installing Piston Rings

Using suitable tool remove piston pin retainer ring at each end of piston pin.

Using a driving tool, drive piston pin from piston. Use a wood block or brass drift as a driver (Figure 8-5). In some instances it may not be necessary to drive piston pin from piston. Specified clearance between piston and pin at room temperature is .0002" to .0004" loose.

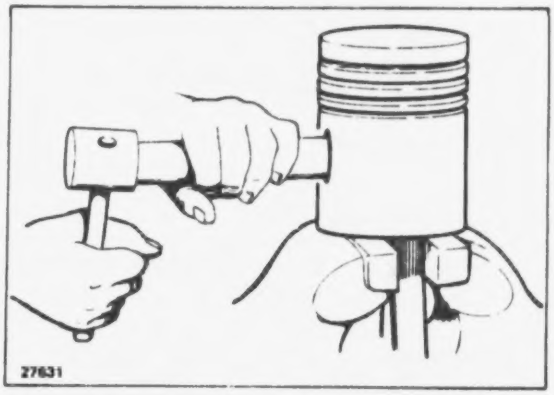


Figure 8-5. Removing Piston Pin from Piston

A pin that is loose enough to drop through the piston by its own weight is considered too loose. From a service standpoint, a fit of this kind, if not due to severely worn parts, will cause an engine to be somewhat noisy but will not necessarily impair performance or reduce engine life. If oversize pins are installed, do not forget to check the fit of the pin in the connecting rod bushing since the new pin will be too snug in a standard rod.

Fitting a piston pin is a precision job. Oversize pins of .005" and .010" are available, if desired. The specified pin clearance in the piston bosses will permit a "hand push" at ordinary room temperatures.

E. PISTON AND PISTON RING INSPECTION

As gummy deposits are not always easily removed with fuel from piston walls and ring grooves, these parts may be cleaned with a solvent and then blown off with dry compressed air. After cleaning, piston skirt, piston rings, and ring grooves should be thoroughly inspected.

> CAUTION: Do not use solvents containing chemicals injurious to aluminum alloy.

Piston skirt should be carefully inspected for score marks or other indications of improper piston clearance. Any scored pistons should be replaced. Inspect inside of piston for cracks, any of which make it unfit for further use. Make certain that drilled holes in piston walls are open and clean.

Check piston for wear by inserting it into cylinder bore and measuring clearance between piston and cylinder wall. The cylinder walls and pistons must be perfectly clean and dry when fitting pistons in the cylinder bores. Pistons should be fitted with the block and piston at room temperature (68° - 70°F).

Check the piston fit in the bore using a half-inch wide strip of feeler stock, .003" thick, attached to a small scale of approximately 15 lbs. capacity (Figure 8-6).

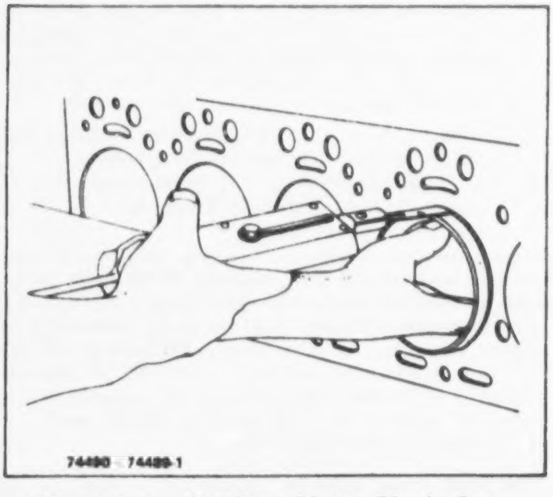


Figure 8-6. Checking Piston Fit in Bore

When the correct fit is obtained, the feeler may be withdrawn with a pull of 5-10 pounds on the scale, with the feeler inserted between the piston and the cylinder, midway between the piston pin bosses where the diameter of the piston is the greatest. Check the fit of the piston when it is approximately 2" down in the cylinder bore in an inverted position.

Piston skirt diameter of a new piston is 3.4120" to 3.4170", measured at right angles to the piston pin.

New piston rings must always be used with new pistons. If engine has been in service for some time, even though same pistons are used again, it is advisable to use new rings when the engine is re-assembled.

F. CONNECTING ROD INSPECTION

Wash connecting rod assembly in clean solvent. Measure outside diameter of piston pin to determine wear. Specified diameter of a new piston pin is .8591" to .8593". Check the bushing in the upper end of the connecting rod for wear. Specified inside diameter of connecting rod bushing is .8595" to .8597". These dimensions of pin and bushing provide a clearance of .0002" to .0006". If clearance is close to or beyond this limit, replace connecting rod bushing.

If bushing is worn, and the original pistons are to be used with a service set of rings, an oversize piston pin may be obtained in .003" or .005" oversize.

The piston pin hole in the piston and the bushing in the connecting rod may be honed to increase their diameter, and to obtain the desired fit as shown in TOPIC 1. FITS AND TOLERANCES.

> NOTE: While the chart specifies a light push fit of the pin in the piston, there is a definite clearance of the piston pin in the connecting rod.

Replace the bushing in the connecting rod if new pistons and sleeves are used. Using an arbor press (Figure 8-7) press out the old bushing and press in the new one - after which the bushing must be honed to obtain the correct fit of the pin in the bushing as shown in TOPIC 1. FITS AND TOLERANCES.

If there is an excess of stock in the piston pin bushing, it may be reamed first, then honed. In any event, the final operation should be done with a hone to obtain the desired fit with better than 75% bearing area on the pin.

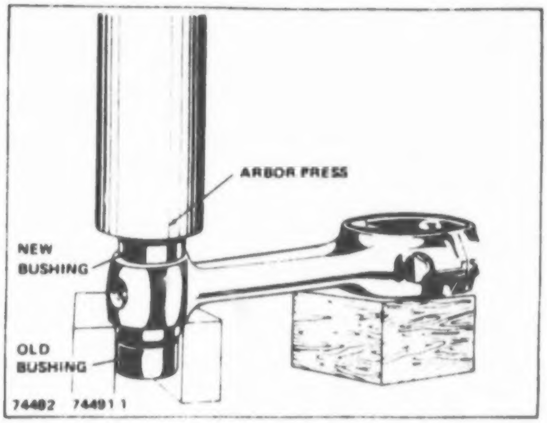


Figure 8-7. Pressing in Piston Pin Bushing

Inspect connecting rod bearing shells for scoring, chipping, corrosion, cracking, or signs of over-heating; discard bearing shells if any of these conditions are apparent. Back of bearing shells should be inspected for bright spots and discarded if any are found, as this condition indicates they have been moving in their supports

Inspect bearing shells for wear. Specified inside diameter of bearing shells when installed with bearing cap retaining bolts tightened to **specified torque is 2.1870" to 2.1865". This provides a running clearance of .0006" to .0022", new bearing shells must be installed when this clearance exceeds .0032". Refer to** TOPIC 6, paragraph D. BEARING INSPECTION AND INSTALLATION, and measure the connecting rod bearings for wear and clearance with the crankshaft in a similar manner. If crankshaft is worn or damaged and must be reground, bearing shells of .002", .010", .020" and .040" undersize, are available.

G. PISTON AND ROD ALIGNMENT

The piston pin hole in the connecting rod must be parallel to, and in plane with, the large bore in the bearing end of the connecting rod.

Alignment may be checked on a fixture with the piston pin assembled in the rod before assem**bling the piston (Figure 8-8). The connecting** rod may be found twisted or bent out of alignment due to wear on the rod bushings or bearings. In this case, the rod may be carefully straightened with a bending bar.

Assemble the pistons on the connecting rod by first heating them in some form of oven or in hot water to a minimum temperature of 160°F. When heated, the piston pin enters the piston very easily, and can be tapped through the connecting rod and into place without distorting the piston.

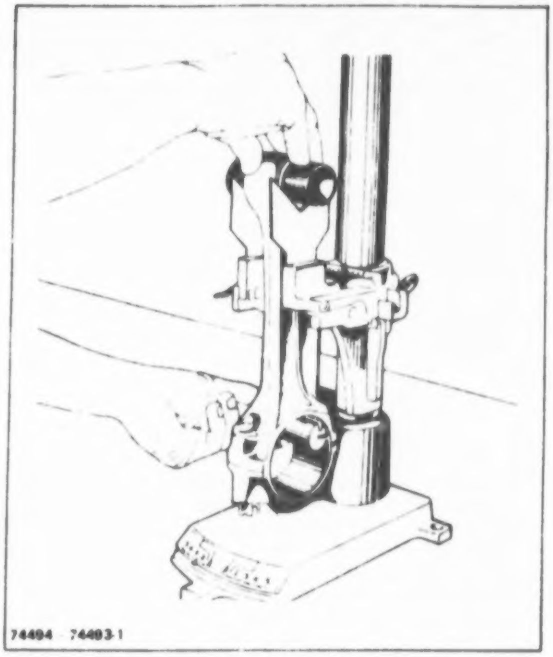


Figure 8-8. Checking Connecting Rod for Twist and Alignment

For each piston, first install one of the piston pin retainer rings, next heat the piston, and then insert the piston pin and install the other retainer ring.

Pistons are cam and taper ground, and this must be taken into consideration when checking alignment of the assembly, since the diameter in line with the piston pin would be less at the top of the skirt than at the bottom.

> NOTE: Ring lands at top of piston are smaller than skirt; therefore, check alignment of rod along full length of skirt only.

Regardless of the preliminary check made on the connecting rod, the completed piston and **rod assembly (Figure 8-9) must be rechecked and** there must not be more than .002" twist or out of squareness checked over a spread of approximately 4 inches. The connecting rod can be bent or twisted with a bending bar to meet this specification.

The snap rings must be assembled in the grooves, making sure they are fully seated in place.

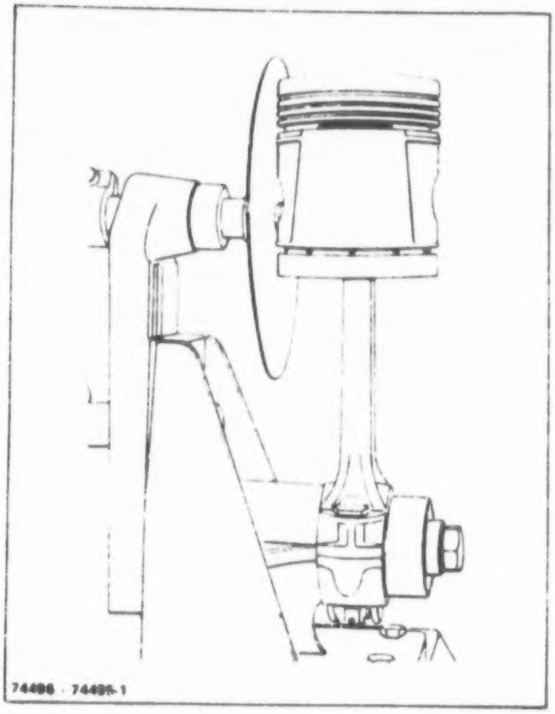


Figure 8-9. Checking Connecting Rod Assembly for Alignment.

H. FITTING PISTON RINGS

Check gap between ends of piston rings before rings are installed on piston. Select rings to be installed on each piston and insert them one at a time into cylinder bore in which they are to operate. Use a piston to push ring squarely into cylinder bore so that it is parallel with top of cylinder block (Figure 8-2).

Check the ring side clearance with a feeler gauge (Figure 8-3) at various positions, in accordance with the tolerances shown in TOPIC 1, FITS AND TOLERANCES.

Measure ring to groove clearance (top of ring to top of groove in piston). The clearances for the two engines are specified in the following table. Use a feeler gauge of the proper dimension to check the clearance.

Piston Ring	Clearance F135
Top	.002"-.004"
Compression	.0015"-.0035"
Oil Control	.000"-.005"

After rings have been properly fitted, install them on piston, using a piston ring remover and installer. Take care not to spread rings more than necessary. Stagger ring gaps evenly around piston so that no two are in line.

Grip the connecting rod in a vise with lead lined jaws to hold the piston firmly and roll each of the straight side rings in its groove to be sure there are no burrs or other interference with the free action of the ring in the groove.

The 3-piece oil ring (Figure 8-10) should be installed first on the piston, from the top side so that the piston skirt will not be scratched.

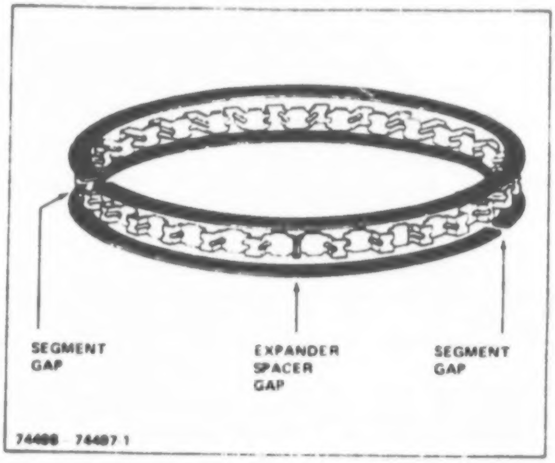


Figure 8-10. Three-Piece Oil Ring

Install oil control ring as follows:

1. Place stainless steel expander spacer of three piece ring in oil groove with ends butted.

2. Install steel segment on top of expander spacer with gap of segment approximately 90° beyond gap of stainless steel expander, making certain expander remains butted.

3. Install second segment on bottom side of expander spacer with segment gap approximately 90° from expander spacer gap in opposite direction from which top segment has been positioned.

4. Recheck installation - oil control ring should be free to move in the groove; however, a slight drag will be noticed due to side sealing action of steel segments. Make sure expander spacer remains butted.

5. Pin milled application - install gap of expander spacer 90° from pin, with hump of expander over pin and ends butted. Install top segment, then bottom segment with gaps of segments over pin.

To install the balance of the rings, use a ring tool with recess side up and place the ring in with the bottom side up. Start with the lowest ring first.

Some piston rings are taper faced. These are clearly marked "TOP" on the side to be up when assembled on piston (Figure 8-11).

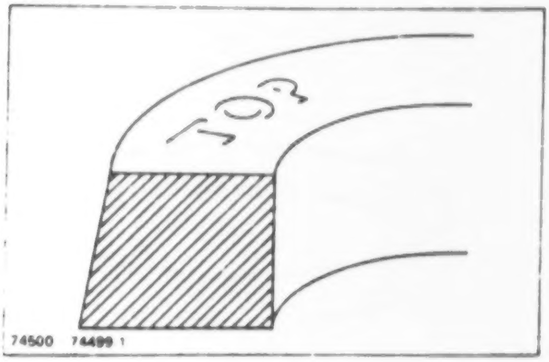


Figure 8-11. Install Tapered Rings with "Top" Side Up

Position ring in the tool so the expanding fingers will fully engage both ends.

Apply pressure on handles so ring is completely expanded. Pass the expanded ring and tool recessed side down over the piston to the proper groove.

CAUTION: If piston is equipped with a steel groove insert, this insert must be installed on top of the number one ring. (The steel groove insert is not part of the re-ring kit, and can be re-used when replacing rings.)

I. INSTALLATION

Oil all rings and pistons before installing them in the cylinder bore.

Replace pistons in the same manner as they are removed, through the top of the cylinder bore. Care should be taken to keep the piston rings properly seated and staggered during insertion.

NOTE: Ensure that pistons, connecting rods and rod caps are all replaced in their respective cylinder locations as removed.

Secure connecting rod to crankshaft, replace rod bearing cap and capscrews and torque to 40-45 lb.ft.

When pistons are ready for installation in the cylinders, compress rings carefully using a good ring compressor. A light tap on the head of the piston will allow the assembly to go into the cylinder very easily. If any difficulty in tapping piston and ring assembly into the cylinder is encountered, the compressor should be removed and rings checked for correct installation in the groove.

Measure the running clearance between piston and cylinder bore as described in preceding paragraph E. Piston and Piston Ring Inspection. The clearance is critical and should be accurate. Pistons are available for redimensioned cylinder bores in .020", .030", .040" and .060" oversizes.

Hold the feeler stock along the side of the cylinder bore at bottom of crankcase. With rod connected insert the piston into the cylinder bore in running position. With the correct clearance between the piston and cylinder bore, the .003" feeler gauge can be with drawn with a slight pull. The pull should not exceed 5 to 10 pounds. Test the clearance at the end of the piston pin and at points 90° from the ends of the pin.

When fitting a piston to a new or accurately resized bore, the bore inner diameter should be the same at top and bottom. Therefore, the clearance may be taken at either end. In bores that have been worn, but not resized, some taper giving extra clearance at the top of the bore is likely. In such cases, the clearance must be checked at the bottom of the bore where the wear is least and the fit is closest.

NOTE: Although the connecting rod bearing side clearance is less critical than the bearing running clearances, no bearing should be assembled without checking the side clearance.

Check the side play of the rods by forcing the connecting rod fully to one side or the other. Insert a feeler gauge between the crankshaft and bearing edge. The desired side play is from .0100" to .0060". If the clearance is excessive, the rod must be replaced. If there is no side play, the piston and connecting rod must be removed and checked to determine cause of binding.

Reinstall oil pan gasket and oil pan. (Refer to TOPIC 15. OIL PAN.)

Reinstall engine. (Refer to TOPIC 17. ENGINE REMOVAL/INSTALLATION.)

TOPIC 9. CAMSHAFT, CAMSHAFT BEARINGS, AND VALVE TAPPETS

A. REMOVAL

1. Refer to TOPIC 17 for engine removal. Refer to TOPIC 18 or 19 for governor removal and camshaft access. Remove camshaft gear nut.

2. Using a puller, remove the cam and crank gears (Figure 9-1).

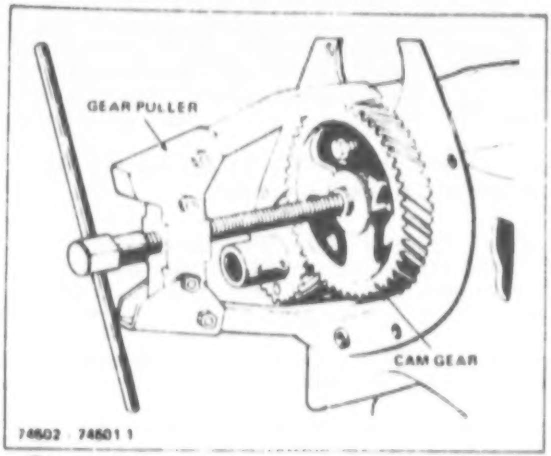


Figure 9-1. Removing Cam Gear with Puller (Typical)

3. Remove the screws holding the camshaft thrust plate to the front of the cylinder block, which makes it possible to pull the camshaft forward out of the bearings.

4. Unless engine is lying on its side, tappets must be removed or lifted before camshaft can be pulled.

5. Remove tappet chamber cover.

6. Tappets can then be lifted out and lined up in sequence, for installation in the same location unless inspection shows that they require replacement. Refer to TOPIC 4. VALVES - INTAKE AND EXHAUST.

7. Before pulling the camshaft completely, check the clearance of the bearing journals in the bushing (or block in some models). To do this use strips of feeler stock .25" wide with edges dressed with a stone to eliminate any burrs or feathered edges.

8. If clearance is equal to or greater than the wear limits specified in TOPIC 1. FITS AND TOLERANCES, check the diameter of the camshaft journals to determine the next step. Excess wear at these positions require replacement of the shaft.

9. If wear is found to be in the bushings instead, these must be replaced using precision service bushings, available for that purpose, which require no reaming, only care in assembly, to line up oil holes, and not damage the bushings as they are being pressed in.

CAUTION: When installing camshaft use special care to prevent camshaft bumping, and loosening expansion plug which cause an oil leak.

B. INSPECTION

1. Checking Camshaft End Play

Camshaft end play is controlled by the thrust plate. The actual distance which the shaft may move forward or rearward depends upon the distance between the rear face of the gear and the front face of the cam journal, minus the thickness of the thrust plate. Thus, when a condition of excessive camshaft end clearance is found, it may be corrected by reducing the distance between the journal and the gear, or by installing a new thrust plate to replace the one which has been worn too thin. If both the thrust plate and the thrust surfaces of the gear and journal are worn, it will be necessary to machine a small amount from the shoulder against which the rear face of the gear hub seats.

Remove enough so that a .005" to .009" feeler gauge may be fitted between the front of the journal and the rear of the thrust plate when the gear is assembled (Figure 9-2). If a condition of insufficient end play is found, use one or two thin shims between the shoulder and the gear.

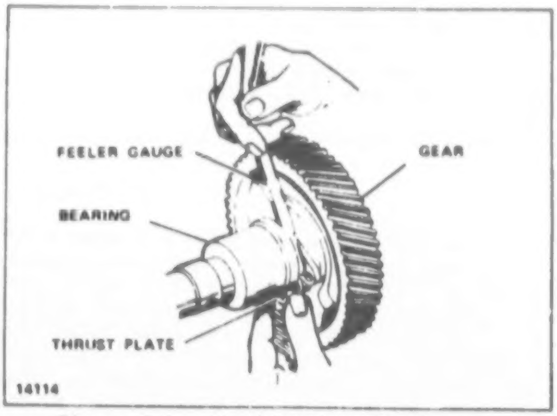


Figure 9-2. Checking Camshaft Thrust Clearance

2. Camshaft Bushings

Camshaft bushings are a thin wall, steel back, babbit lined type with a split line which must close together when the bushing is pressed in the crankcase. For proper installation it is necessary to have suitable driving tools with an arbor and shoulder of the correct diameter to drive the bushing into place true and straight without battering or buckling. The press fit is approximately .005". It should be noted that a chamfer is provided on one edge of the bushing to aid in starting the installation. It is very important to locate the bushing in the case so the oil passage holes align with the holes in the crankcase.

The bushings must be finish reamed after installation to provide finished inside diameters as follows:

Front:	1.8745" to 1.8755"
Center :	1.7495" to 1.7502"
Rear:	1.2495" to 1.2505"

To ensure satisfactory alignment, the reaming should be done with a piloted tool which maintains the same center through the crankcase.

C. INSTALLATION

Carefully slide camshaft into block, making sure that cam gear is in correct timing with crank gear. Replace valve tappets in their respective locations. Ensure camshaft is properly supported by cam bearings and secure with thrust plate and capscrews. Tighten to recommended torque.

Refer to TOPIC 18 or TOPIC 19 and install the governor and timing gear cover.

Replace side cover plate and secure. Install oil pump, distributor drive, oil pan and oil pan capscrews. (Refer to respective installation sections if necessary.)

Replace manifold and carburetor, if removed. (Refer to TOPIC 3. MANIFOLD.)

See ENGINE REMOVAL AND INSTALLATION for installation instruction.)

TOPIC 10. GEAR TRAIN

A. DESCRIPTION

Correct timing sequence of the gear train is critical to proper engine operation; it is accomplished by meshing the camshaft drive gear and governor drive gear timing marks, with their respective timing marks on the crankshaft timing gear.

F163 Engine

The gear train (Figure 10-2) consists of the crankshaft gear, camshaft gear and fan drive gear. The crankshaft gear drives the camshaft gear, which in turn drives the fan drive gear. The governor drive assembly is attached to the camshaft by the camshaft gear nut. A governor race assembly is attached to the camshaft. Correct timing sequence of the gear train is critical to proper engine operation. It is accomplished by meshing the camshaft drive gear and crankshaft gear timing marks. The fan drive gear has no timing marks and has only to be meshed with the camshaft gear when installed.

B. REMOVAL

Refer to respective sections for crankshaft, camshaft and governor removal and installation. Also see TOPIC 17. ENGINE REMOVAL/INSTALLATION.

The crankshaft, camshaft and governor and/or fan drive gears should be thoroughly cleaned and inspected for cracked or chipped teeth before reassembly. It is generally desirable to replace all the gears when one or more are worn badly enough to require replacement; however, such drive train replacement is not recommended as a field procedure because of the need for selecting gears with the proper running clearance.

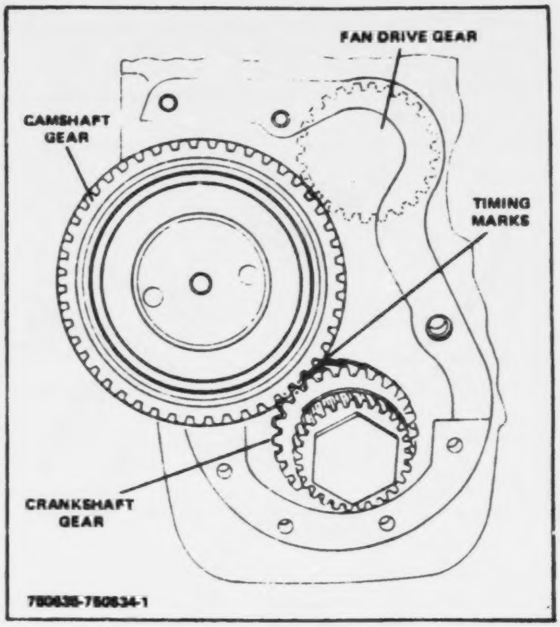


Figure 10-2. Gear Train (F163)

Replacement crankshaft and camshaft gears are furnished in standard size, under size, and over size. Gears marked "S" are standard; if they are marked "U" with the number 1, 2, or 3, it signifies .001", .002", or .003" under size. Similarly, oversize gears are marked "O" with the number 1, 2, or 3.

> NOTE: A standard crankshaft gear with a .002" oversize cam gear on the engine, could be replaced with a .001" crank gear and a .001" oversize cam gear, or any other combination that gives a .002" oversize dimension.

C. INSPECTION

Timing gears and timing gear fits must be checked carefully. To check the fit, use a screw driver to force the mating teeth as far apart as possible and check this clearance with feeler gauge (Figure 10-3). If this clearance is .002" or greater, or if the gear teeth are badly scuffed and worn, the gear must be replaced. Timing gears must be replaced in pairs.

best copy available
Reproduced from poor document.

Gears fitted with excessive backlash usually chatter at idling speeds while gears too tightly fitted will howl or whine. It is better for gears to be slightly loose than to ride hard.

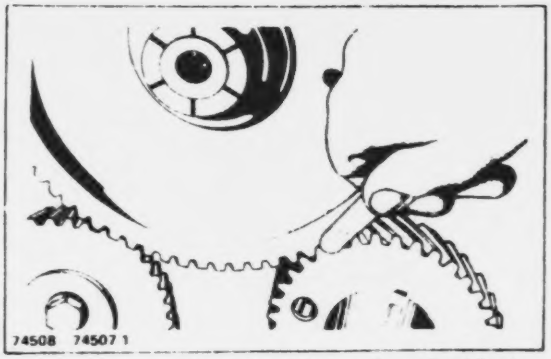


Figure 10-3. Checking Timing Gear Backlash (Typical)

Gears marked same as the original as far as sizes are concerned should be used as replacements.

Carefully examine the camshaft thrust plate (Figure 10-4) for scoring and wear and if any indication of either shows, a new thrust plate should be assembled without question. Refer to TOPIC 9 to check end play.

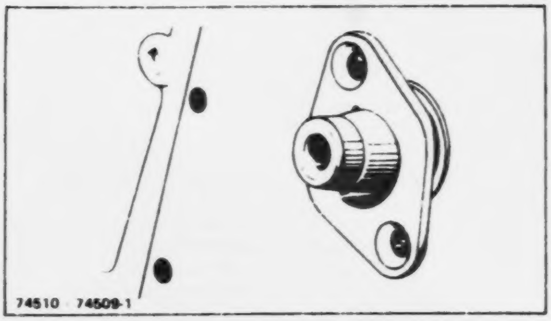


Figure 10-4. Camshaft Thrust Plate

D. INSTALLATION

1. Refer to sections covering crankshaft, camshaft, governor and engine removal and installation.

2. Assemble the cam gear to the camshaft by driving or pressing it on, at the same time holding the camshaft forward with a suitable bar through the fuel pump opening in the block so there is no possibility of the camshaft bumping the expansion plug at the rear end and forcing it out of position, thus causing an oil leak.

3. On F163 engines, install the driver assembly (Figure 10-5) and camshaft nut. On F135 engines install the camshaft gear nut only. Tighten camshaft gear nut to a torque of 175-180 lb. ft. (Figure 10-6).

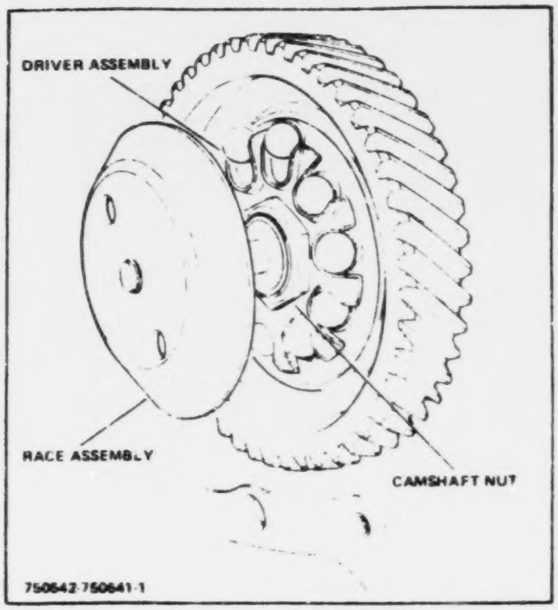


Figure 10-5. Camshaft Gear Nut Installation (F163 Engine)

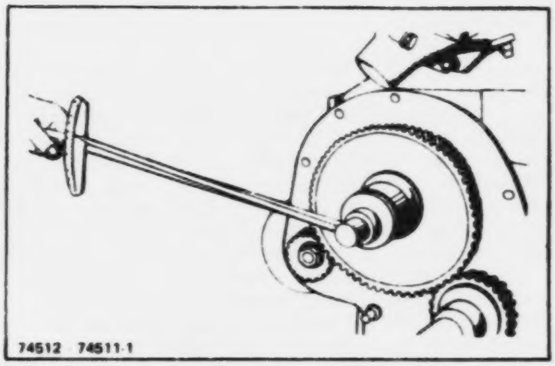


Figure 10-6. Torquing Cam Gear Nut (Typical)

4. Check camshaft end play as shown in Figure 10-7. Refer to TOPIC 1. FITS AND TOLERANCES section for the correct dimension.

CAUTION: NEVER USE THE CAMSHAFT NUT TO PULL THE GEAR ONTO THE CAMSHAFT. This will damage threads of the steel camshaft.

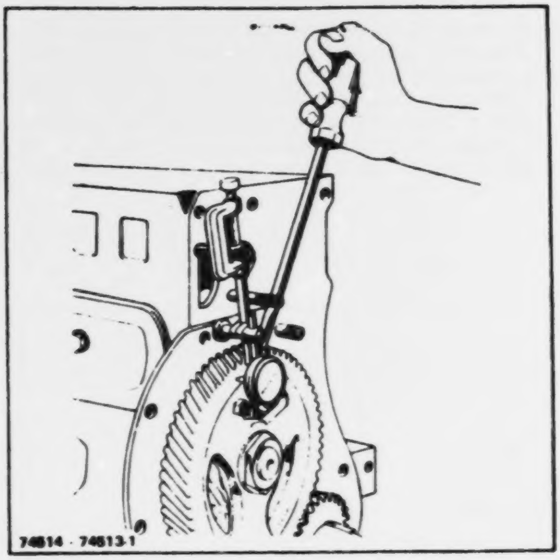


Figure 10-7. Checking Camshaft End Play

5. If the crankshaft gear requires replacement then a suitable puller will be necessary as this gear is shrink fitted on the shaft.

6. Use a driving sleeve to tap the gear snugly into place. Hard driving is not necessary and indicates that the gear is cocked on the shaft.

7. Drive the crank gear on the shaft making sure that the marked teeth on the cam gear straddle the marked tooth on the crank gear (Figure 10-8) which assures that the crankshaft and camshaft are in time.

8. To be certain that there is enough clearance, hold finger at the junction of the two gears and, with a light hammer, tap the rim of the cam gear and note if there is vibration felt at this point (Figure 10-9).

9. If there is vibration and a .0015" feeler gauge will not enter the gap between the two gear teeth, the gear fit is within specifications.

10. Check the crankshaft end play before replacing the gear cover.

11. Crankshaft thrust is controlled by **flanged center bearings (Figure 10-10)** which require no shims. If end play exceeds .006" (using a feeler gauge) replace the flanged bearings. End play should be between the .002" and .006" limits.

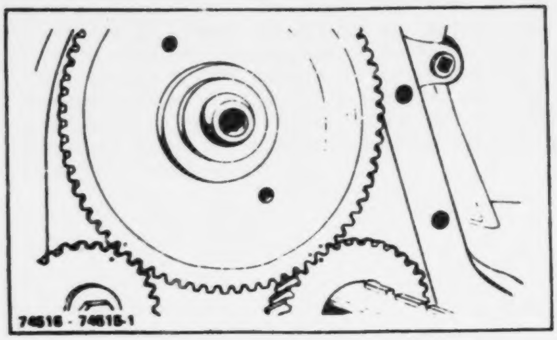


Figure 10-8. Timing Gears Assembled According to Timing Marks

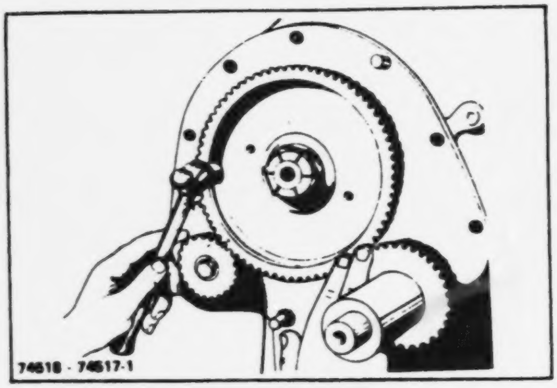


Figure 10-9. Checking Gear Fit

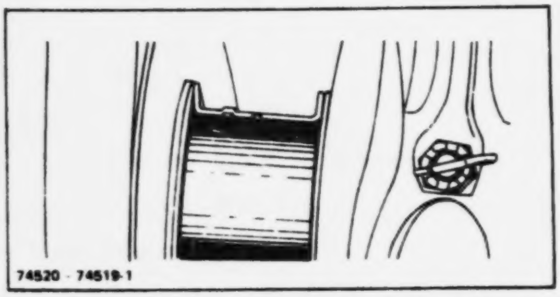


Figure 10-10. Flanged Bearing Controls Crankshaft End Play.

12. When installing the timing gear cover, the seal should be replaced. Always replace the gasket between the cover and the engine.

13. **Refer to TOPIC 18 or 19 and install the governor and gear cover**

MEMO

TOPIC 11. CYLINDER BLOCK

A. DESCRIPTION

The cylinder block and crankcase (Figure 11-1) are cast as a single unit. Bearing crosswalls and water baffles are generously filleted, and the honed cylinder bores are exposed to the coolant for their entire length. Intake and exhaust ports are arranged along the upper left side of the cylinder block. Directly below is the valve and tappet chamber covered with a cover plate. The lower left side of the crankcase is ribbed lengthwise to incorporate a rifle drilled oil passage. A spring loaded oil pressure relief valve is mounted just below the center of this oil passage to provide a means of adjusting the oil pressure. Towards the front is an oil outlet providing lubrication for the governor.

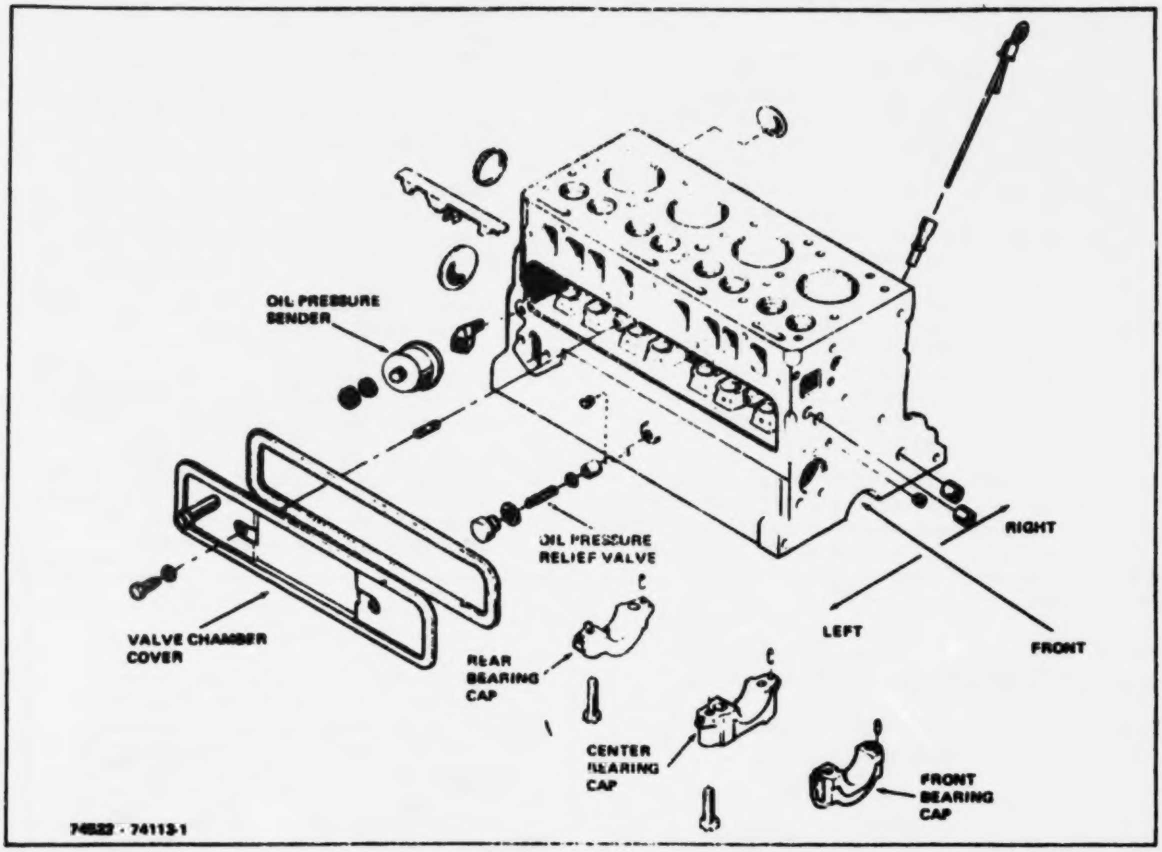

OIL PRESSURE SENDER
OIL PRESSURE RELIEF VALVE
RIGHT
LEFT
FRONT
VALVE CHAMBER COVER
REAR BEARING CAP
CENTER BEARING CAP
FRONT BEARING CAP
74522 - 74113-1

Figure 11-1. Cylinder Block Components

The rear face of the crankcase provides an accurately machined surface for mounting the flywheel housing. A semi-circular groove in the rear face of the crankcase around the rear main bearing receives a semi-circular oil guard, and a filler block which is held in place by two machine screws. Oil guard and filler block contain a pressed-in oil seal to prevent the entrance of foreign material around the main bearing.

The camshaft extends the length of the left side of the crankcase and runs in three pressed-in bushings which are drilled for pressure lubrication from drilled passages in the crankcase.

The three main bearing locations are machined to receive thin-wall precision type bearings. No shims are used between the case and the bearing cap. The center main bearing is flanged on both sides to absorb crankshaft end thrust and to locate the crankshaft lengthwise. The three main bearing caps are doweled on both sides to provide for an accurate and rigid alignment. The upper and lower halves of the precision type bearing shells are alike and are located by small tabs which fit recesses in the case. The front and center bearings have a single groove in each shell which extends out a short distance from the oil hole and blends into the bearing contour. The rear bearing has two holes connected by an oil channel.

If the same connecting rod bearings are to be re-used, be sure the bearing shells are kept in order with respect to which connecting rod they go in, which is top and which is bottom. However, re-use of bearing shells is not recommended.

B. REMOVAL

Refer to ENGINE REMOVAL AND INSTALLATION.

Refer to relevant sections for removal/installation instructions.

C. INSPECTION

Important points on cleaning and inspection to be observed are as follows:

1. Clean oil pan thoroughly. Remove oil gallery plug and clean all passages with solvent and compressed air. Clean valve compartment thoroughly. Clean crankshaft oil passages.
2. Carefully inspect the condition of the crankshaft journals and crank pins. These surfaces must not be scored or burred and should be checked with a micrometer against specifications as tabulated in TOPIC 1. FITS AND TOLERANCES.
3. Clean pistons of all carbon, being particularly careful to see that the ring grooves are clean and oil drain holes in oil ring groove are clean of all carbon. Inspect pistons for any cracks in head or in piston pin bosses.
4. Clean oil passage in each connecting rod and check each piston and rod assembly for correct alignment.
5. Clean valve guides and valves to remove head and stem deposits. Check fit of valves in guides and tension of valve springs.
6. Check that valve tappets are free fit in block without perceptible side play or shake. Inspect for rough or grooved faces, and be sure heads of adjusting screws are smooth.
7. Check general condition of camshaft. Journals should not be scored or burred. Cams should be smooth and free from burrs or grooving.
8. Inspect crankcase for cracks, especially in the exhaust valve area.
9. Clean the ring of carbon from around the top of the cylinder bore formed above the travel of the top ring.
10. Determine the original diameter of the cylinder barrel by checking this unworn area with an inside micrometer at intervals of approximately 45°.

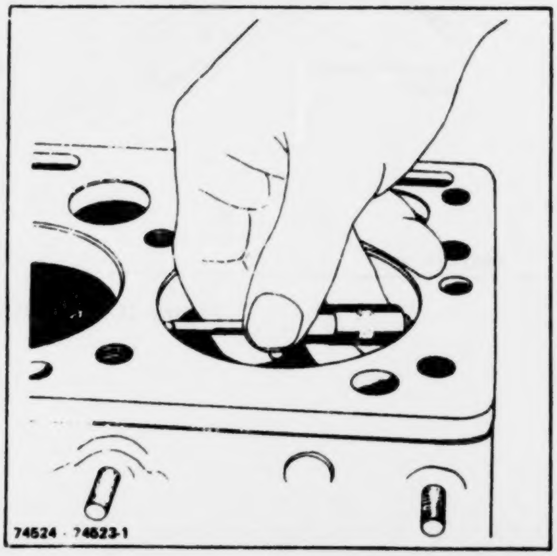


Figure 11-2. Measuring Original Bore Diameter Above Ring Travel.

11. Check in same manner the top of the ring travel area, approximately 1/4" below the shoulder.

12. The maximum difference in checks 10 and 11 indicates the amount of cylinder bore wear. If this difference is less than .008", re-ringing will be suitable, and if over .008" re-boring is recommended.

D. PREPARING CYLINDER WALLS FOR RE-RINGING OR RE-BORING.

1. Ridge ream the cylinders to remove the unworn area at the top so that new rings, when assembled, will not bump and distort both themselves and the piston lands (Figure 11-3).

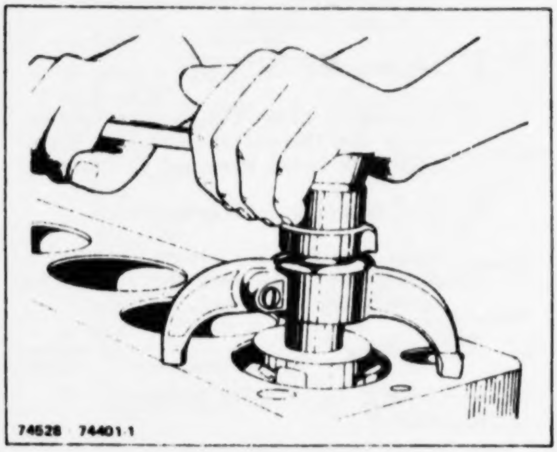


Figure 11-3. Ridge Reaming Top of Cylinder Bore

Several good makes of ridge reamers are available which will ream the top of the bore in direct relation to the worn area so that should the worn area be off center slightly there will be no partial ridge remaining.

2. When re-boring the cylinders allow .002" for finishing by honing.

3. To get the correct cross hatch pattern (Figure 11-4) with a cylinder hone, use a top quality electric drill with a speed of 500 RPM or less.

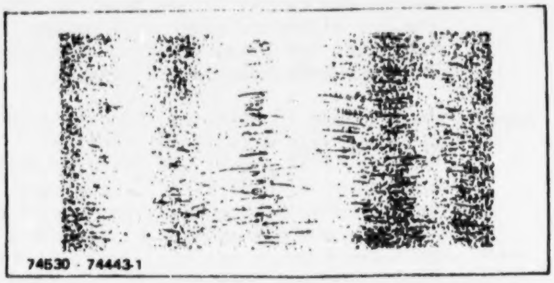


Figure 11-4. Desirable Cross Hatch Pattern After Cylinder Hone.

E. GLAZE BREAKING OPERATION

It is important to remove the glaze on the cylinder bores by using a cylinder hone which has an adjustable stone tension (Figure 11-5). Glaze breaking assures quick seating of new piston rings. If the cylinder glaze is not removed, there will be no assurance as to when the rings will begin to function properly and control the oil; this is especially true when chrome rings are used.

The following step by step procedure is recommended:

1. When the crankshaft has not been removed, cover the entire crankshaft with a clean, slightly oily cloth to prevent abrasives and dirt from getting on the crankshaft.

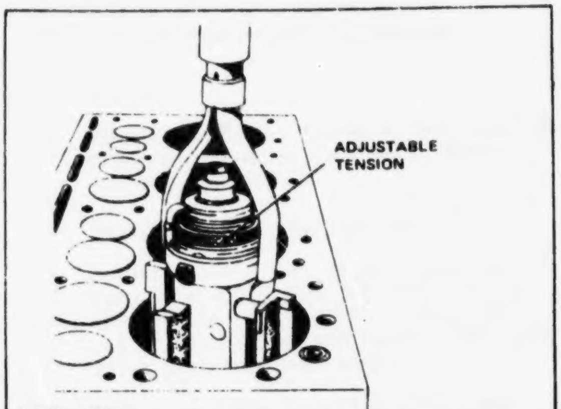


Figure 11-5. Honing Cylinders

2. Remove the excess carbon deposits from the top of the cylinder wall before beginning the glaze breaking operation. This prevents loading the stones.

3. Insert hone in cylinder and expand to cylinder wall with slight tension. Using a clean brush, wet cylinder wall and stones with kerosene. Use a hand drill and surface hone cylinder with a rapid up and down motion to produce a good cross hatch pattern (Figure 11-4). Apply kerosene occasionally as needed and increase tension on hone adjustment until a good pattern and finish are obtained. A smooth finish of 10 to 15 micro inches is desired.

4. Clean the loose abrasives from the stones by using kerosene and a wire brush.

NOTE: Stones must be used wet. Keep applying kerosene during honing to prevent stones from drying out and causing an incorrect honing pattern.

5. The most desirable cylinder finish is 10-15 micro inches; with this finish the depressions in the surface tend to keep the supply of lubrication between the mating parts. This finish can be obtained by using 280 grit stones on the hone.

6. Clean all bores thoroughly with a clean oiled rag to pick up all the small particles of dust that may be embedded in the walls. Follow this with a clean cloth to make certain the walls are CLEAN.

F. PREVENTIVE MEASURES

When cylinders and pistons are scored or worn excessively, the following most common causes should be considered, in order to eliminate those conditions during future operation of the engine.

1. Gum or Varnish Deposits:

   Use heavy duty lubricating oil, change the oil more often or reduce the oil temperature.

2. Piston Skirt Clearance Inadequate:

   When fitting new pistons, follow the recommendations listed in TOPIC 1. FITS AND TOLERANCES.

3. Insufficient Cooling:

   Thoroughly clean the cooling system, check the thermostat and water pump. Make sure hoses have not collapsed.

4. Dirt Entering Intake Manifold:

   Adopt improved air cleaner servicing procedures. Make sure the air cleaner connections are tight.

G. INSTALLATION

(Refer to TOPIC 17. ENGINE REMOVAL/INSTALLATION.)

TOPIC 12. OIL PUMP

A. DESCRIPTION

The lubricating oil pump (Figure 12-1) is a positive, gear type assembly. It consists of a single cast pump housing and mounting extension with a precision cavity to receive the driver and idler gears. The driver gear is mounted at the end of the pump shaft, and the idler gear is mounted on a stud which is pressed in place in the pump body.

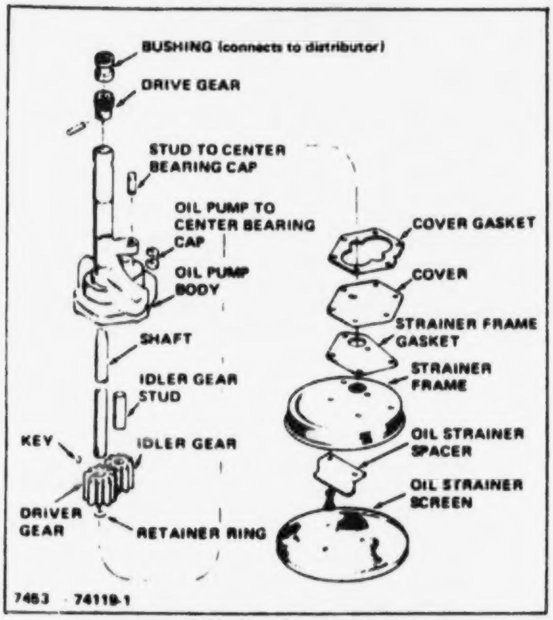

BUSHING (connects to distributor)
DRIVE GEAR
STUD TO CENTER BEARING CAP
OIL PUMP TO CENTER BEARING CAP
OIL PUMP BODY
SHAFT
IDLER GEAR STUD
KEY
IDLER GEAR
DRIVER GEAR
RETAINER RING
COVER GASKET
COVER
STRAINER FRAME GASKET
STRAINER FRAME
OIL STRAINER SPACER
OIL STRAINER SCREEN
7463 · 74119-1

Figure 12-1. Oil Pump, Exploded View

The oil pump is assembled to the center main bearing cap held in position vertically against a machined pad by studs.

The extended portion of the pump body acts as a pilot, fitting closely in a reamed hole in the main bearing web, maintaining definite relationship between the camshaft and the oil pump drive shaft.

A gear assembled to the upper end of the drive shaft is driven by a mating gear cut on the camshaft. The mating gear drives the oil pump gear which is assembled to the lower end of the pump shaft.

The pump shaft is carried in two bronze bushings assembled in the cast iron housing, which is also a part of the oil distributing system. transmitting oil to the drilled passages.

B. REMOVAL

1. Refer to TOPIC 17. ENGINE REMOVAL/INSTALLATION.
2. Drain oil pan, and remove the capscrews securing the oil pan. Remove the oil pan and its gasket.
3. With the engine resting on its side, remove nut and washer holding the oil pump assembly to the center main bearing cap. Remove the oil pump assembly (Figure 12-2).

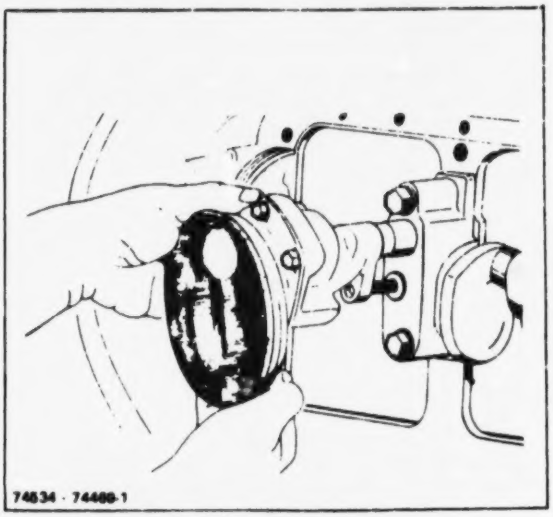

74534 · 74488-1

Figure 12-2. Oil Pump Removal

C. DISASSEMBLY

1. Remove screen and remove screws securing frame and cover to pump body. Remove spacer and frame.
2. Remove oil pump cover and gasket.
3. Support spiral gear at the upper end of pump on a wood block and drive out retaining pin with a drift. Press shaft out of spiral gear and remove shaft and drive gear from pump body.
4. Remove retainer ring from drive gear end of shaft and place shaft on suitable support in an arbor press. Remove gear from shaft.
5. Remove idler gear from stud.
6. Clean all parts in an acceptable solvent and dry with compressed air.

D. INSPECTION

1. When the pump is removed, examine the drive gear carefully for wear, inspecting the gear on the camshaft at the same time. If scored or worn badly, both the camshaft and the gear on the pump must be replaced.

2. Examine the pick-up screen for clogging or damage.

3. Remove the cover, being careful not to damage the lead gasket which acts as a spacer as well as a gasket to seal the joint.

4. Examine the gears and pump body for any sign of wear indicating lack of clearance. The gears should have from .001" to .003" clearance in the chamber and should make no contact with the walls (Figure 12-3).

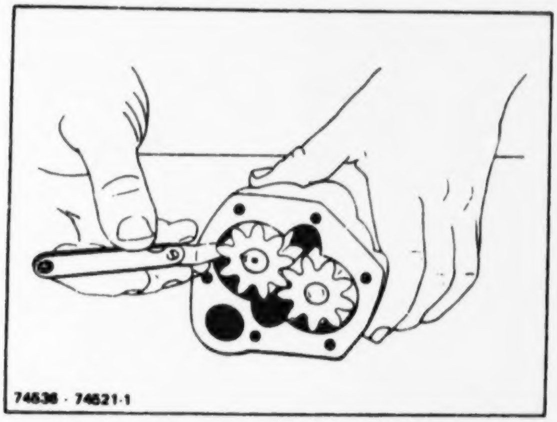


Figure 12-3. Checking Oil Pump Gear Clearance in Pump Body

5. Inspect the cover and face of the gears for excessive wear or scoring. With the gasket assembled to the body there should be .0015" to .006" clearance between the gears and the cover (Figure 12-4).

6. Worn or scored gears can be replaced, as can a worn cover. If the body shows wear in the chamber, it can be replaced; but, in a case like this, a new pump would be the most economical.

7. Engine oil pressure must be maintained to specification for satisfactory engine life.

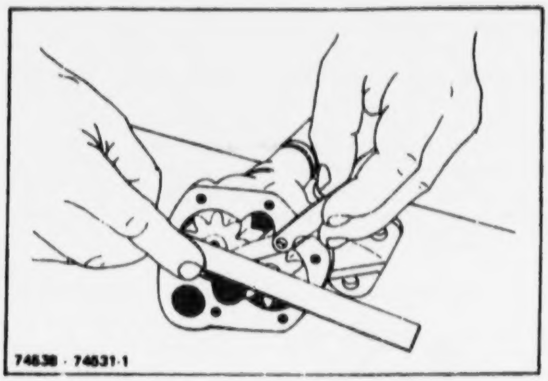


Figure 12-4. Checking Oil Pump End Clearance

E. ASSEMBLY

Press drive gear on its shaft and install shaft in pump body. Secure with snap ring. Press spiral gear back on end of drive shaft and replace retainer pin. Replace idler gear, if it was removed, and install oil pump cover and gasket. Install spacer, frame and screen.

F. INSTALLATION

1. Re-install oil pump assembly on center main bearing cap. Carefully manipulate the pump assembly to allow the spiral gear to mesh with the camshaft mating gear, and with the bushing connecting to the distributor drive. Make sure the oil pump assembly is properly seated on the center main bearing cap, and secure with lockwasher and nut.

2. Install oil pan with new oil pan gaskets. Secure oil pan with attaching capscrews and make sure drain plug is installed.

3. Install engine in truck (refer to TOPIC 17. ENGINE REMOVAL/INSTALLATION.

4. Upon complete re-assembly, ensure that proper weight and quantity of oil have been poured into crankcase, refer to Maintenance Module LUBRICANT AND FUEL SPECIFICATIONS

5. Start engine, check for oil leaks.

6. Refer to TOPIC 13. OIL PRESSURE RELIEF VALVE ADJUSTMENT to verify proper oil pressure setting.

7. Turn engine off.

TOPIC 13. OIL PRESSURE RELIEF VALVE

A. DESCRIPTION

Stabilized lubricating oil pressure is maintained within the engine at all speeds, regardless of oil temperature, by means of the oil pressure relief valve. This valve is located on the left side of the engine, directly below the carburetor (Figure 11-1). The valve assembly consists of a plunger, compression spring, adjusting washer or washers, copper gasket, and a plug screwed on the crankcase valve opening (Figure 13-1). When oil pressure at the valve exceeds the 30-40 P.S.I. limit, the plunger is lifted off its seat, and oil from the main gallery is by-passed to the engine oil pan.

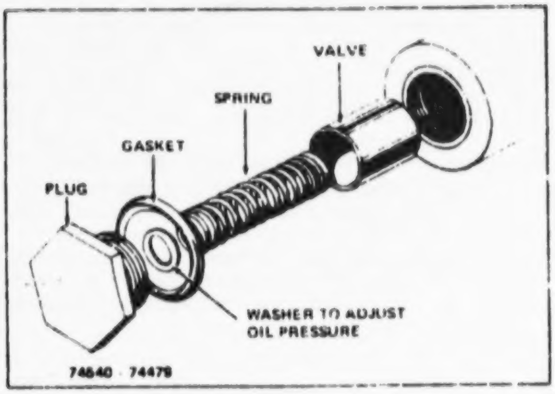


Figure 13-1. Oil Pressure Relief Valve Assembly

B. REMOVAL

Under normal conditions, the valve requires very little attention. However, if the lubricating system has been allowed to sludge up, the regulator valve may not work freely, thereby remaining open or closed. Whenever the lubricating oil pump is removed for repairs or inspection, the regulator valve should also be disassembled, thoroughly cleaned, and parts inspected.

C. DISASSEMBLY

If, with the proper grade of oil, and the engine warmed up and running at normal governed speed, and after adjusting the relief valve the oil pressure is unusually high or low, the following corrective measures should be tried:

1. Remove and clean relief valve parts of dirt, sludge, or carbon.
2. Check oil temperature and condition of oil.
3. If both the relief valve and oil are in good condition, be sure to check the oil pressure gauge and its connections before going any farther.
4. A common source of low oil pressure is clogging of the oil pump intake screen with sludge and carbon. Remove such deposits with a solvent.
5. Unusual looseness, grooving, or damage to the camshaft bearings or oil pump will also cause low oil pressure. Such conditions call for replacement of worn parts.

D INSPECTION

Clean oil pressure relief valve parts with a solvent and dry with compressed air. Replace the spring if it is worn, bent out of shape, cracked, or weak. Replace copper gasket to form an oil tight seal.

E. ADJUSTMENT

The only adjustment variation is, either to install a new compression spring, or to assemble or remove washers from behind the existing spring. Up to four washers can be assembled.

Whenever a relief valve adjustment is necessary, it should be done AFTER the engine and oil have reached normal operating temperatures. It is equally important that all other factors such as grade and condition of oil, bearing clearances, and security of line connections be satisfactory before any adjustment is attempted. Proceed as follows :

1. Allow engine to run until oil reaches normal operating temperature.
2. Check oil pressure at oil pressure gauge on instrument panel; verify adjustment using calibrated oil pressure gauge.
   a. Recommended pressure with engine hot at an idle is 5 to 10 P.S.I.
   b. Recommended pressure with engine hot at full throttle is 30 to 40 P.S.I.
3. To increase pressure, assemble washers one by one. If after assembling four washers pressure is still low, replace compression spring.
4. To decrease pressure remove the existing washers, one by one. If pressure is **still high, replace compression spring.**
5. After adjustment is completed, install a new copper gasket, install and tighten plug.

TOPIC 14. FILLER BLOCKS AND OIL GUARD

A. DESCRIPTION

The rear and front main bearings are sealed to the cylinder block and the oil pan by a rear oil guard, rear filler block, and a front filler block; these three components are semicircular die castings equipped with jute seals **and neoprene seals (Figure 6-1). The oil guard fits in the cylinder block, just to the rear of the rear main bearing. The rear filler block is** assembled to the cylinder block with capscrews, directly under the oil guard.

Jute seals are mounted on the inner semicircular grooves of the rear oil guard and filler block, where contact is made with the crankshaft. The outer semicircular groove of the rear filler block also has mounted a neoprene seal where contact is made between the filler block and the oil pan.

The front filler block is assembled to the front of the cylinder block with capscrews. A neoprene seal is mounted on the outer semicircular groove of the front filler block to seal the connection with the oil pan.

B. REMOVAL

1. Refer to TOPIC 6. CRANKSHAFT COMPONENTS for access to Filler Blocks and oil Guard.
2. With the engine resting on its side, remove the rear and front filler blocks.
3. Remove the crankshaft.
4. Remove the oil guard.

C. SERVICING

1. Remove the jute seals and neoprene seals from the oil guard and the filler blocks; thoroughly clean inner and outer seal grooves to remove all dried cement and grease.
2. Install jute seals on the oil guard and the rear filler block. Refer to **Figures 14-1 and 14-2.**
3. Jute packing for crankshaft seal as it is received is approximately one-third larger in diameter than the width of the groove. To fit the grooves in the filler block, the packing must be crushed in a vise or flattened with a **hammer** on a flat surface so the jute packing is narrow enough to fit into the grooves.

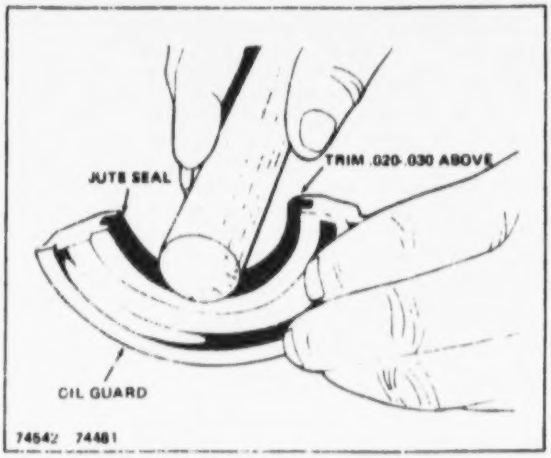


Figure 14-1. Installing Jute Seal in Oil Guard

4. Press packing seal into the grooves of both the filler block and the oil guard. Then, using a piston pin, a smooth hammer handle, or some other instrument with a rounded surface, iron this packing into the groove so that it is seated firmly and expanded so that is seizes the sides.

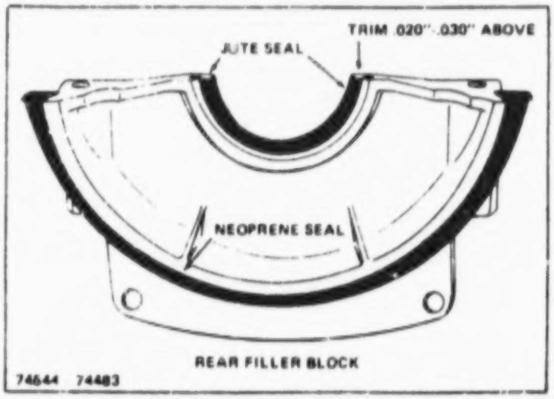


Figure 14-2. Installing Jute Seal in Rear Filler Block

NOTE: After installation, the jute packing will protrude from the grooves at either end in varying amounts. With a sharp knife, or razor blade, cut **this off to project .020"-.030" above, making the cut parallel to the surface of the casting. Then slip it into place, either around the crankshaft, if the engine is still assembled, or directly into the groove if the crankshaft is out.**

Replace the neoprene seal by holding it in place for assembly (Figure 14-2 and 14-3). Use only a small spot of non-hardening cement in center of the contacting surface, before inserting seal in groove. No other cement is required.

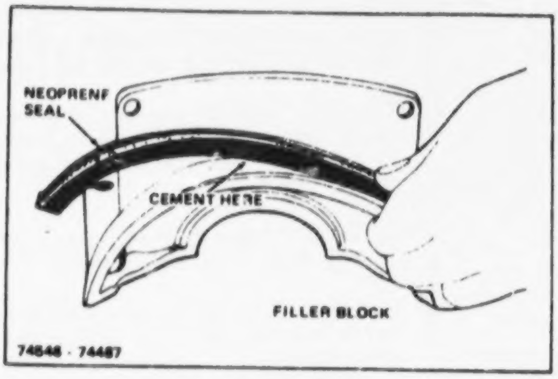


Figure 14-3. Installing Neoprene Seal in Rear Filler Block

Install the neoprene seal in the front filler block in the same manner as in the rear filler block (Figure 14-4).

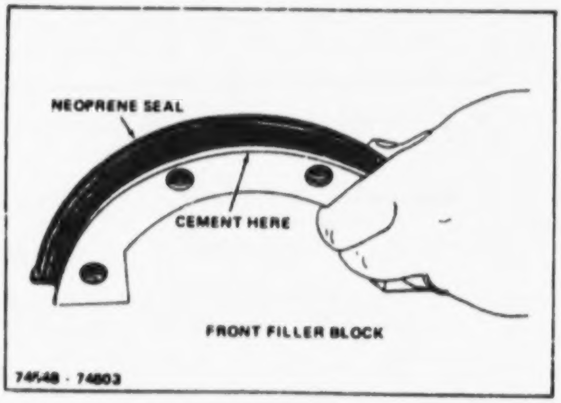


Figure 14-4. Installing Neoprene Seal in Front Filler Block

D. INSTALLATION

> NOTE: When replacing the front filler block capscrews, make certain capscrews include a nylock patch to lock screws firmly in place.

Torque nylock patch screw to 15-20 pounds foot.

Lubricate outside of rear and front neoprene seals before installing oil pan to prevent possible distortion of seals.

When replacing gear cover, cement cover with a quick drying gasket cement and reassemble **to engine block (Figure 14-5).**

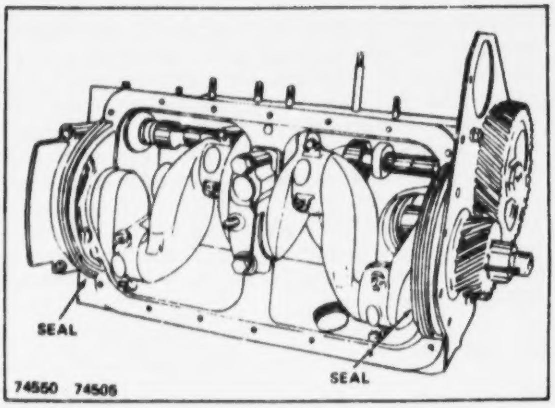


Figure 14-5. Neoprene Seals in Place

In order to prevent possible oil leaks, it is imperative to use only genuine Allis Chalmers replacement gaskets and seals--since these have been engineered and designed to do a superlative job. However, it has been determined **that 90% of all rear main oil seal leak complaints checked are leaks in the pan gasket, rocker covers, side covers, etc., and are not leaking rear main oil seals.**

The following is a suggested procedure to determine the exact location of an oil leak:

1. Wipe the under side of the engine to clean all dirt and oil from the oil pan, etc.
2. Plug breather pipe and oil filler opening with rags.
3. With the engine idling, blow compressed air (35 p.s.i. or less) into the dip stick pipe or opening.
4. Watch for oil leak and trace to the source.
5. Determine whether the oil is coming from the pan gasket, pan gasket end seal, leaky fitting, rocker cover gaskets, push rod cover gasket, or from any source other than the rear main oil seal.
6. A small mirror and flashlight are handy tools to use in checking hard to see places.

TOPIC 15. OIL PAN

A. DESCRIPTION

The oil pan (Figure 6-1) which is the reservoir for engine lubricating oil, contains a drain plug which is removed for periodic draining of oil. The oil pan is sealed and secured to the crankcase assembly with a gasket and capscrews. Front and rear of the oil pan have semi circular cuts which receive the filler blocks assembled to the cylinder block. The filler blocks contain oil seals and guards to prevent foreign material from entering the front and rear main bearings. Refer to TOPIC 14. FILLER BLOCKS AND OIL GUARD.

B. REMOVAL

Engine must be removed in order to detach oil pan.

1. Run engine until normal operating temperature is reached.
2. Remove oil pan drain plug, and drain oil.
3. Remove engine (see ENGINE REMOVAL.)
4. With the engine resting on its side, remove capscrews from edge of oil pan, and remove oil pan.

C. INSPECTION

1. Wash oil pan with cleaning solvent and dry with compressed air.
2. Inspect oil pan for evidence of cracks or other damage. Inspect drain plug boss for evidence of leakage. Make necessary repairs or replacement.
3. If engine has not been overhauled, inspect filler block neoprene seals to make certain they are in good condition. If seals need replacement follow the procedure in TOPIC 14. FILLER BLOCKS AND OIL PAN.

D. INSTALLATION

> NOTE: New style oil pans are sealed with a form-in-place gasket. The oil pan has been changed to a flat rail to accept the sealant.

1. Refer to Figure 15-1 when applying the liquid gasket to the oil pan.
2. For best results the pan should be assembled within five minutes of applying the liquid form-in-place gasket.
3. Refer to Figure 6-1 for positions of the form-in-place gasket.
4. Position oil pan on cylinder block rails and secure with lockwashers and capscrews. Torque capscrews to 18 to 21 ft. lbs.
5. Install drain plug in oil pan.
6. Fill oil pan with correct oil and replace oil filter.

> NOTE: When changing oil, the oil filter must also be changed, and 4½ qts. of oil replaced.

For different climates the following oil weights are recommended:

Temperatures below 32°F,	S.A.E.20
between 32°F-90°F	S.A.E.30
above 90° F	S.A.E.40

7. Run engine and check for oil leaks around oil pan and at filter.

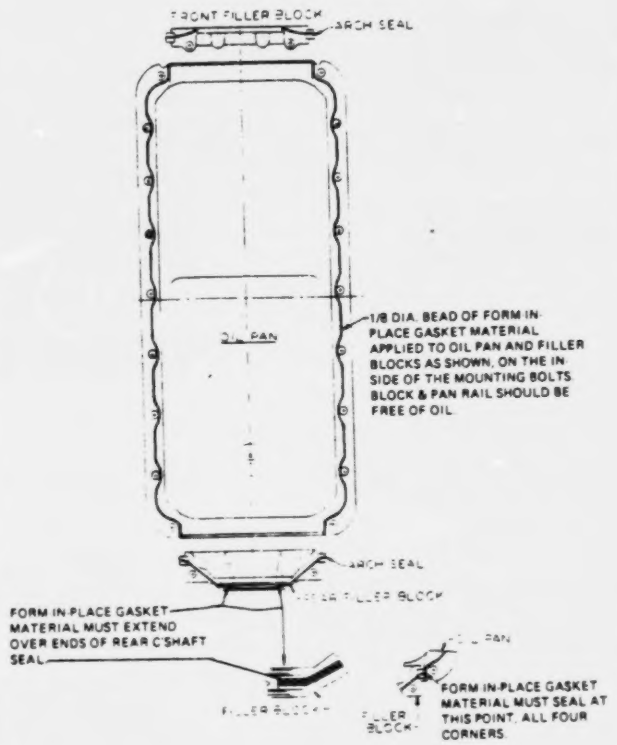

FRONT FILLER BLOCK
ARCH SEAL
1/8 DIA. BEAD OF FORM IN-PLACE GASKET MATERIAL APPLIED TO OIL PAN AND FILLER BLOCKS AS SHOWN, ON THE INSIDE OF THE MOUNTING BOLTS. BLOCK & PAN RAIL SHOULD BE FREE OF OIL.
OIL PAN
ARCH SEAL
REAR FILLER BLOCK
FORM IN-PLACE GASKET MATERIAL MUST EXTEND OVER ENDS OF REAR C'SHAFT SEAL
FILLER BLOCK
OIL PAN
FILLER BLOCK
FORM IN-PLACE GASKET MATERIAL MUST SEAL AT THIS POINT, ALL FOUR CORNERS.

Figure 15-1. Oil Pan Form-in-Place Gasket Installation Instructions

MEMO

TOPIC 16. ENGINE RUN-IN SCHEDULE

A. PURPOSE

After installation of new engine, or one in which new pistons and piston rings have been installed engine must be run-in to allow piston rings to seat and avoid possibility of cylinder bore scoring and excessive oil consumption. When engine is first started after installation of new pistons and piston rings, excessive smoke, raw fuel and lubricating oil may appear in the exhaust. This condition should correct itself as engine is run-in.

Test run engine after overhaul and make adjustments as are found necessary for smooth and efficient engine operation.

b. TEST RUN CHECKS

The following procedure is recommended with engine installed in truck.

> CAUTION: Ensure engine has been cleared of all rags, tools, parts, oil, water, etc., prior to engine run-in.

1. Fill crankcase to correct oil level with oil specified in Maintenance Module, LUBRICANT AND FUEL SPECIFICATIONS.
2. Fill cooling system with proper coolant for summer or winter operation. Refer to COOLING SYSTEM Section.
3. Inspect air cleaner to determine if properly serviced. Lubricate all points where lubrication is required.
4. Start engine and allow to run at approximately 600-700 R.P.M. Check for oil, fuel or coolant leaks. Check coolant and oil levels. If engine is run indoors, pipe exhaust gases outside.
5. Check oil pressure gauge. If gauge does not register during first 30 seconds after starting, stop engine at once and refer to TROUBLE SHOOTING Section.
6. Check ammeter. If not functioning correctly, check electrical system for grounds, shorts or loose connections.
7. Check engine timing. Refer to FUEL SYSTEM Section.
8. After engine has reached normal operating temperature, remove valve chamber cover and check valve clearances.
9. A run-in period of six to eight hours is recommended. Start with no load and gradually increase engine load until operating at full load for the last two hours.
10. At end of run in gradually slow down engine and allow it to idle for a few minutes, allowing engine to cool gradually.
11. Torque cylinder head capscrews.
12. Recheck crankcase oil level and any points of adjustment, making necessary corrections.
13. Warm up engine to operating temperature. Blow dirt out of pockets around spark plugs,remove plugs. and insert compression gauge in first spark plug hole, holding it firmly. Crank engine until the highest gauge reading is obtained. (Approximately four compression strokes). Check all cylinders in this manner. If readings are low in two adjacent cylinders, a blown head gasket is indicated. If readings are low and vary widely (more than 10 PSI), pressure is being lost either at the pistons, rings or valves. To determine where pressure loss is occuring, insert about one tablespoon of SAE 30 engine oil through the spark plug hole. Take a new reading. If this reading is higher than the initial reading, the piston rings are faulty. If reading is the same as the initial reading, the valves may be leaking or the cylinder head gasket is damaged.

TOPIC 17. ENGINE REMOVAL/INSTALLATION

Engine removal and installation is easily and safely accomplished when reasonable care and attention to detail is exercised. The following procedure is recommended for efficient engine removal and installation.

A. REMOVAL

CAUTION: Disconnect battery leads before attempting removal. Remove battery and battery tray. Disconnect and label any attaching wiring.

1. Attach an acceptable hoist chain to counterweight eyelets and take up slack in chain.
2. Remove securing counterweight capscrews and remove counterweight, taking care not to damage radiator or hydraulic pump.
3. Remove radiator cap slowly, to ensure against scalding, and open petcock at base of radiator and on engine block, to drain water from block and radiator.
4. Remove upper and lower radiator hose clamps and hoses. (Guard against damage to thermostat mounted at base of upper hose.) Disconnect transmission cooling oil lines.
5. Remove radiator.
6. Remove fan blade attaching capscrews and fan blade.
7. Loosen alternator adjusting brace, remove and inspect fan belt for possible cuts or cracks. Replace if necessary upon engine installation.
8. Disconnect and immediately cap hydraulic lines at hydraulic pump. Remove hydraulic pump, pump gear and sleeve.
9. Disconnect and label attaching alternator wiring.
10. Remove securing alternator capscrews and alternator.
11. Disconnect spark plug ignition wires at plugs and mark.
12. Remove spark plugs and cap or tape exposed ports to prevent contamination.
13. Remove distributor cap with attaching ignition coil and spark plug wiring.
14. Cover exposed distributor base to prevent entrance of foreign particles.
15. Disconnect and label oil pressure and temperature sender wires. Disconnect neutral start switch wires.
16. Remove attaching clamps, capscrews and nuts, and disconnect exhaust pipe. Tape exposed exhaust manifold port.
17. Remove oil pan drain plug and drain crankcase.
18. Remove transmission drain plug and drain transmission oil.
19. Disconnect and label engine oil filter lines. Remove oil filter and attaching bracket.

CAUTION: Cover or plug all open lines to prevent contamination of engine systems.

20. Loosen air cleaner hose clamps and wing nut. Remove air cleaner and attaching parts.
21. Disconnect transmission oil filter lines, where applicable, and label.
22. Disconnect accelerator linkage and choke control at carburetor.
23. Close fuel tank shut-off valve and disconnect fuel line to fuel strainer.
24. Disconnect transmission linkage, and cooling lines.
25. Disconnect universal joint at transmission.
26. Install lifting eyes in engine and transmission.
27. Firmly attach hoisting chain to lifting studs and take up slack in chains.

CAUTION: Make certain that all electrical wiring, mechanical linkage and attachments, and hoses are free and clear of engine/transmission attachment or obstruction prior to removal or installation.

28. Remove engine motor mount bolts.
29. Slowly hoist engine assembly free of frame ensuring that engine and attached transmission do not bind or bump against the frame resulting in possible injury or unnecessary damage.

30. Once free of the frame, lower engine onto engine support and after proper seating and weight support is ascertained, remove hoisting chain.

31. With transmission properly supported by attaching hoist chain, remove securing capscrews and carefully disengage transmission assembly from engine.

B. INSPECTION

Look engine over closely for any signs of damage, wear or evidence of leaks. Necessary action should be taken to correct any abnormal conditions.

C. INSTALLATION

1. Ensure that engine is free of rags, tools, extra parts, excess water, oil, fuel cleaning agents.

2. Make certain that any maintenance performed was properly done and that nuts and capscrews are all torqued to specification.

3. Refer to REPAIR MANUAL - TRANSMISSION and install transmission on engine.

4. Properly attach hoisting chain to engine and transmission lifting eyes and take up slack in chain.

> CAUTION: Be certain that frame, engine and transmission mounting areas are clear of any obstructions such as wiring, hoses, mechanical linkage, etc., prior to installation.

5. Carefully maneuver engine assembly into mounting position and slowly, guarding against any binding, lower assembly onto engine mounts.

6. Install and secure mounting bolts. Torque to 20 lbs. ft.

7. Disengage hoisting chain and clear from work area.

8. Refer to REPAIR MANUAL - UNIVERSAL JOINTS AND COUPLINGS and connect universal joint to transmission.

9. Refer to REPAIR MANUAL - TRANSMISSION and connect transmission linkage and cooling lines. Install transmission drain plug.

10. Connect transmission oil filter lines and inspect filter for contamination or scheduled replacement. Change if required.

11. Remove transmission oil level stick and fill with specified transmission oil to full mark, as indicated on oil level stick.

> CAUTION: Do not over-fill transmission.

12. Replace oil pan drain plug, and close coolant drain cock at radiator and cylinder block.

13. Replace oil filter cartridge and connect oil filter lines to engine as labeled and connect oil filter lines to engine as labeled.

14. Connect accelerator linkage and choke control at carburetor.

15. Connect fuel line to fuel strainer.

16. Install exhaust pipe and attaching clamps and hardware.

17. Verify proper electrode gap, .025", and install spark plugs. Torque plugs 25-30 lbs. ft.

18. Replace distributor cap with attaching ignition wires. Remove labeling tape as ignition coil and spark plug wires are properly affixed.

19. Connect temperature sender and oil pressure sender wires. Connect neutral start switch wires.

20. Install alternator and mounting hardware but do not lock adjusting brace at this time. Connect associated alternator wiring.

21. Inspect belt for wear, replace if necessary, and mount on fan drive pulley, water pump and alternator pulleys.

22. Secure alternator adjusting brace for fan belt depression of ¼" - ½" with 10 lbs. of pressure applied.

23. Install air cleaner and attaching hardware, hoses and clamps. Inspect filter element for contamination and replace if necessary.

24. Replace fan blade and secure capscrews.

25. Install hydraulic pump sleeve and gear and install pump. Connect hydraulic lines

to pump. If contamination of hydraulic oil is suspected, drain reservoir, change filter and replace oil, after filtering oil through a 10 micron, or finer, filter.

26. Install radiator, taking care not to damage cooling fins, and replace upper and lower radiator hoses, thermostat and hose clamps.

27. Connect transmission oil cooling lines to radiator.

28. Replace counterweight and secure capscrews.

CAUTION: Use extreme care when replacing counterweight to prevent personal injury or damage to equipment.

29. Replace grille and secure.

30. Replace angle braces, seat plate, engine cover and side panels, and seat. Replace floor and toe plate.

31. Install battery tray and battery. Connect any wiring removed from tray attachment and connect battery terminal leads.

32. Fill radiator to capacity with water. Add anti-freeze if required.

33. Fill crankcase with 4.5 quarts of recommended engine oil. Check oil level stick for full reading.

NOTE: Ensure that all hoses, electrical lines and mechanical linkages have been completed. Be sure all capscrews, braces and mounts are secure.

34. Check fuel tank for water condensation: drain if necessary.

35. Fill tank to recommended limit with proper octane gas and open fuel cut-off valve.

36. Start engine, run at idle for approximately 5 minutes, then shut off and check radiator water level, crankcase dipstick and transmission oil level stick for full capacities.

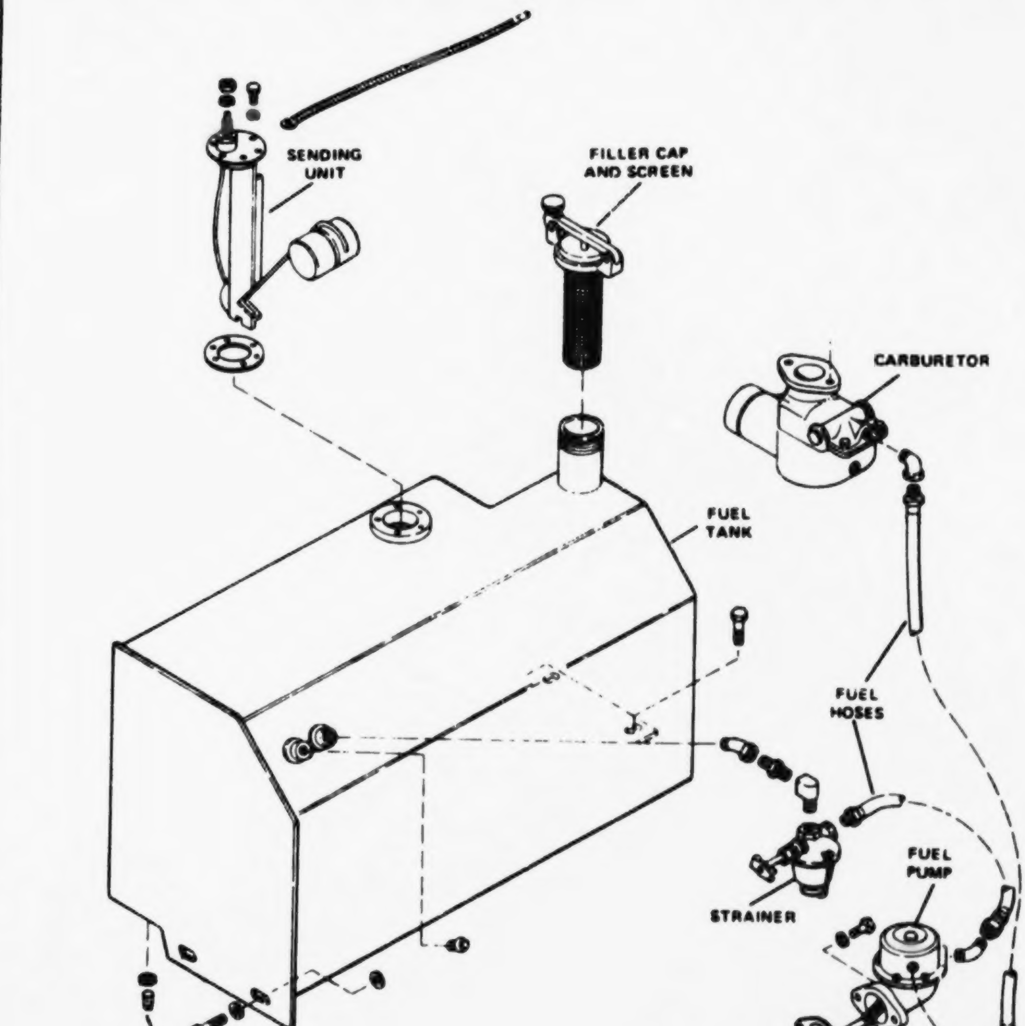
37. Check for evidence of oil, fuel or water leaks.

38. Continue with engine run-in schedule as specified.

TOPIC 1. FUEL SYSTEM

The following components make up the fuel system: The fuel tank, fuel pump, strainer and filter, the carburetor, accelerator linkage and the governor assembly.

The fuel tank is the fuel reservoir and, via the fuel lines, fuel pump, strainer and filter, supplies the carburetor with raw fuel to be vaporized and mixed with fresh air for controlled combustion.


SENDING UNIT
FILLER CAP AND SCREEN
CARBURETOR
FUEL TANK
FUEL HOSES
FUEL PUMP
STRAINER
DRAIN PLUG

750623-750623-1

Figure 1-3. Fuel System (Type III)

TOPIC 2. FUEL TANK

A. DESCRIPTION

The fuel tank is of steel construction and welded seams. It includes a fuel level sender unit, a filler cap with filter screen and the fuel outlet line and fittings.

The fuel tank requires little, if any, service other than periodic cleansing of the fuel filter.

B. REMOVAL

1. Remove the fuel tank drain plug from bottom of tank or open shutoff cock and allow fuel to drain.
2. Remove the floor and toe plates.
3. Raise the left side of the truck sufficiently to allow removal of the fuel tank.
4. Remove hose from top of tank and the fuel gauge sender wire (Fig. 1-1).
5. Disconnect fuel gauge sender wire. Close cock at bottom of tank and disconnect tube from shutoff cock (Fig. 1-2).
6. Disconnect fuel gauge sender wire. Disconnect hose from fuel strainer and remove strainer from tank (Fig. 1-3).
7. Remove the filter cap assembly.
8. Remove the capscrews, lockwashers, and washers which secure the fuel tank to the truck.
9. Carefully remove the fuel tank from the under side of the truck.

C. DISASSEMBLY AND INSPECTION

1. Remove necessary fittings from tank and allow remainder of fuel to drain.
2. Clean filler cap and filter screen assembly with acceptable solvent and dry thoroughly with compressed air.
3. If removal of fuel sending unit is necessary, remove capscrews and lockwashers (Figure 1-1) that secure sending unit to tank. Carefully lift unit out of tank being certain not to bend float arm.

D. ASSEMBLY AND INSTALLATION

1. If removed, carefully install fuel sending unit, ensuring against any damage to float arm.
2. Install capscrews and lockwashers and secure tank to frame.
3. Replace the fuel tank drain plug.
4. Replace fuel filler assembly.
5. Before installing tank, disconnect fuel line at fuel pump and blow out line with compressed air.
6. Inspect copper fuel line and fuel hose for damaged connectors, crimped line, cracks or oil soaked hose. Replace damaged lines.
7. Install fuel tank as removed and replace capscrews, washers and nut which secure the top and rear of the tank to the truck. Lower truck to ground level.
8. Attach fuel sender wire.
9. Replace previously removed fittings and hose (Fig. 1-1).
10. Connect tube to shutoff cock at bottom of tank (Fig. 1-2).
11. Connect fuel strainer to elbow in top of tank and connect hose to strainer (Fig. 1-3).
12. Fill fuel tank to recommended capacity with proper octane fuel.
13. Check all fittings and lines for any leaks. Repair, if required.

MEMO

TOPIC 3. FUEL PUMP AND FUEL FILTER

A. DESCRIPTION

The fuel pump is a mechanical diaphragm type with an attached strainer and sediment bowl. The pump is mounted on the side of the engine and is operated by an eccentric on the engine camshaft.

Fuel from the tank enters the strainer sediment bowl on the suction stroke of the pump and is forced to the carburetor on the pressure stroke. Action is controlled by two valves in the cover assembly.

On ACP model trucks the fuel strainer is connected directly to the tank and fuel is delivered to the fuel pump through a connecting hose (Fig. 1-3).

B. SERVICE AND INSPECTION

Quite often engine malfunctioning can be traced to a clogged fuel pump; therefore, periodically clean sediment bowl and strainer screen.

Loosen capnut, swing clamp wire to one side, and remove bowl. Thoroughly clean bowl and screen. If there is excessive dirt on the screen or in the bowl, check fuel tank and source of supply.

If pump is supplying insufficient fuel, engine will stall or falter. Check the following:

1. Make sure there is fuel in the tank and the shut-off valve at sediment bowl is fully open.
2. Disconnect fuel outlet line from pump. Remove high tension wire from ignition coil and turn the engine over several revolutions. If fuel spurts from pump outlet, it indicates pump, gas lines and fuel tank are not at fault.
3. If little or no fuel flows, perform the following:
    a. Check for leaking gasket at sediment bowl or top cover of the pump.
    b. Remove and clean fuel screen in sediment bowl.
    c. Inspect copper fuel line for restrictions. Blow out with compressed air or replace if damaged.
    d. Inspect flexible fuel line for breaks or a porous condition. Replace if necessary.
    e. Make certain all pump cover screws are tight.

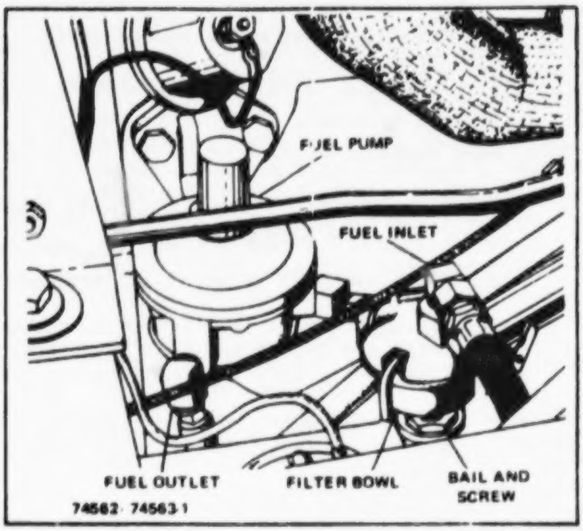


Figure 3-1. Fuel Pump and Filter Mounting (ACC Model Trucks)

    f. Test pump for proper operating pressure by disconnecting outlet line and attaching test gauge to fuel outlet port. Run engine at 1800 r.p.m. on fuel remaining in carburetor and note pressure on gauge. Pressure should be between 1-1/2 P.S.I. minimum and 2-1/4 P.S.I. maximum. Pressure below minimum indicates excessive wear. It may also indicate a ruptured diaphragm, worn, dirty or gummy valves and seats. Any of the above require removal of the pump for replacement.

If pump is supplying too much fuel, it will drip from the carburetor, or the engine will not idle smoothly, and will be hard to start. Check the following:

1. Perform Step f above for testing the pump for proper operating pressure.
2. A pressure above maximum indicates too tight a diaphragm or too strong a diaphragm spring. Poor riveting on a diaphragm assembly may also result in too high a pressure due to fuel seeping between diaphragm layers, bulging the diaphragm and causing it to act as if it were stretched too tightly. The above requires removal of the fuel pump for replacement.

3. Loose fuel line at carburetor.

4. Excessive use of hand choke.

5. Punctured carburetor float.

6. Defective carburetor needle valve.

7. Incorrect carburetor adjustment.

C. PUMP REMOVAL

1. Lift operator's seat, and swing open right hand side panel.

2. Close shut-off valve at sediment bowl.

3. Disconnect fuel outlet line to carburetor and disconnect fuel inlet hose from supply line from fuel tank.

4. Remove the pump mounting capscrews and lockwashers and lift pump from engine.

5. Wash pump and sediment bowl with a solvent and dry with compressed air.

D. FILTER DISASSEMBLY

1. Remove flexible fuel line and elbow from fuel filter cover. Leave shut-off valve open.

2. Loosen clamp nut, move clamp to one side and remove sediment bowl, gasket and screen.

E. INSPECTION

Clean and rinse all parts in an approved solvent and dry with compressed air.

Make a visual check for cracks and breakage. Examine all threaded holes and filter screen. Replace broken or damaged parts.

F. FILTER ASSEMBLY (ACC TRUCKS)

1. Install filter cover nipple and filter cover on fuel pump cover. Tighten securely to prevent fuel leakage.

2. Install filter screen and gasket in filter cover, place bowl in position and tighten clamp.

3. Install elbow and flexible fuel line in top of filter cover.

G. PUMP AND FILTER INSTALLATION (ACC TRUCKS)

1. Secure pump and filter assembly to engine with capscrews and lockwashers.

2. Attach fuel lines from tank and carburetor. Make certain all connections are tight.

3. Open shut-off valve at filter and start engine. Check all connections for leaks.

4. Swing shut the right hand side panel and lower the operator's seat.

H. FILTER ASSEMBLY (ACP TRUCKS)

1. Install elbow in filter cover and install cover on fitting in full tank (Fig. 1-3).

2. Install filter screen and gasket in filter cover. Install bowl and tighten clamp.

3. Connect fuel hose to filter.

I. PUMP INSTALLATION (ACP TRUCKS)

1. Install pump and gasket on engine and secure with capscrews and lockwashers.

2. Attach fuel line from filter and fuel line to carburetor.

3. Open shutoff valve at filter and start engine. Check all connections for leaks.

4. Close the right hand side panel and lower operator's seat.

TOPIC 4. CARBURETOR

A. DESCRIPTION

The carburetor is of the single barrel updraft design, with a single venturi, twin floats, and a semi-concentric fuel bowl to permit operation at quite extreme angles without flooding or starving the engine. It is of the "balanced" and "sealed" type since all air for fuel bowl ventilation and idle operation must enter through the air cleaner. The fuel supply system is made up of the threaded fuel inlet, fuel valve (needle and seat), float assembly and the float chamber. The idle system consists of two idle discharge holes, idle air passage, idle adjusting needle, idle jet, and fuel pick-up passage. The high speed (main metering) system consists of the venturi, main jet, main discharge and well vent. Some models also include a main jet adjustment. The choke system is of the semi-automatic type and is made up of a choke plate, with a spring loaded poppet valve, mounted on a shaft located within the air intake and operated externally by a lever attached to the choke shaft.

B. OPERATION

1. Fuel Supply System. Fuel under pressure is supplied through the fuel inlet fitting, fuel valve (needle and seat) to the float chamber, see Figure 3. The float in the float chamber automatically regulates the opening through the fuel valve (needle and seat) to maintain the proper level of fuel in the fuel bowl and to meet the demands of the engine according to engine load and speed.

2. Idle System. At idle speed the throttle plate is advanced slightly to expose the upper idle discharge hole to engine manifold vacuum (suction), see Figure 4. This suction is transmitted to the idle jet through a passage connecting the idle discharge holes with the idle jet. Fuel for idle is supplied through the main jet to a well at the bottom of the discharge jet. The fuel for idle flows out of this well through a restricted drilling at the bottom of the idle fuel pick-up passage. From here the fuel is metered through the idle jet calibration before entering the vacuum passage leading to the idle discharge holes. As the fuel leaves the idle jet it is mixed with air that originates back of (or from behind) the venturi. The position of the idle adjusting needle in this passage controls the suction on the idle jet and thereby the idle fuel air mixture. Turning the idle adjusting needle IN (clockwise) results in a greater suction on the idle jet with a smaller amount of air admitted to give a richer mixture. Turning the needle OUT (counterclockwise) increases the amount of idle air admitted and reduces the suction on the idle jet resulting in a leaner mixture. This idle fuel-air mixture is then discharged through the idle discharge holes into the air stream.

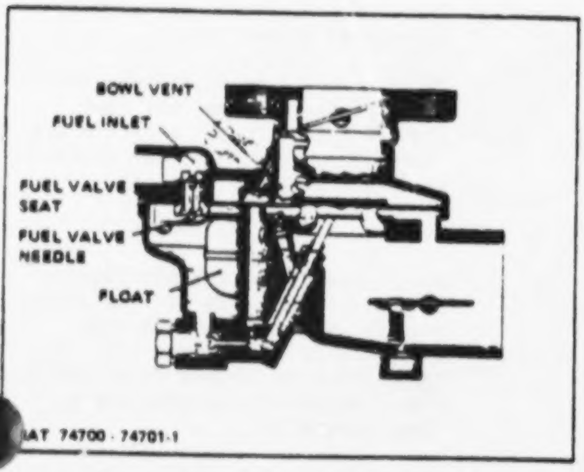


Figure 3. Fuel Supply System

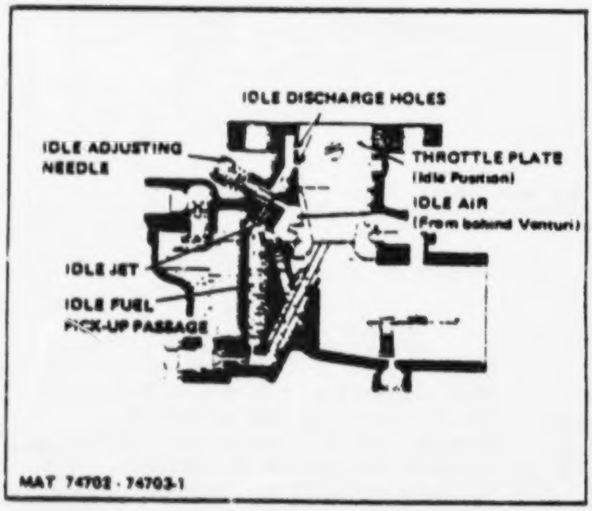

IDLE DISCHARGE HOLES
IDLE ADJUSTING NEEDLE
THROTTLE PLATE (Idle Position)
IDLE AIR (From behind Venturi)
IDLE JET
IDLE FUEL PICK-UP PASSAGE
MAT 74702 - 74703-1

Figure 4. Idle System

3. High Speed (Main Metering) System. As the throttle is advanced to approximately one-quarter opening, the amount of air passing through the venturi creates a suction on the tip of the main discharge jet. This suction causes the fuel to flow from the fuel chamber through the main jet and into the main discharge jet where it is mixed with air admitted by the well vent jet. This mixture is then discharged into the air stream through the discharge jet, see Figure 5. The main jet controls the fuel delivery from about one-quarter to full throttle opening. To maintain a proper mixture ratio a small amount of air is admitted through the well vent into the discharge jet through air bleed holes located in the discharge jet at a point below the level of fuel in the metering well.

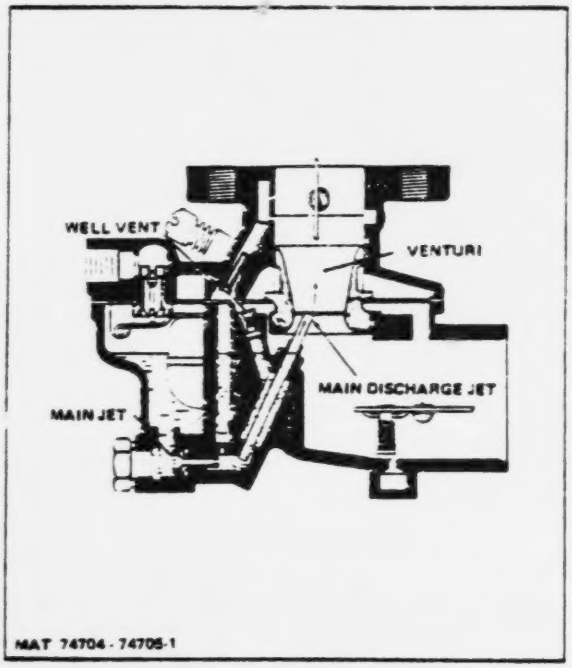


Figure 5. High Speed System

4. Choke System. Closing the choke plate when starting a cold engine restricts the air entering the carburetor through the air cleaner and creates an increase in suction on the jets. This increase in suction causes more fuel to be drawn into the engine and provides a richer mixture necessary for starting a cold engine. As soon as the engine starts to operate, the spring-loaded poppet valve located within the choke plate opens to prevent over-choking. As the engine warms, the choke must be opened manually to the wide open position.

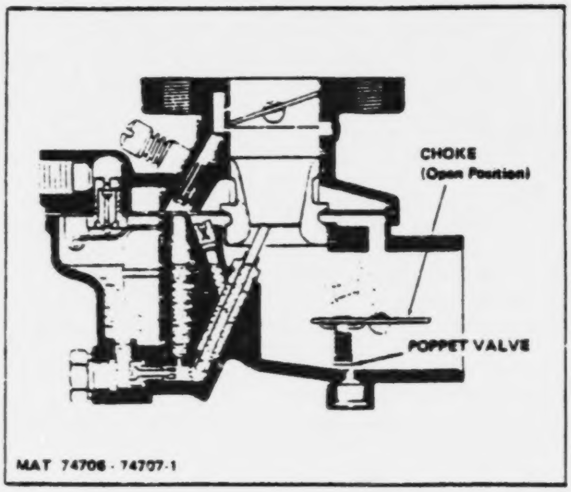


Figure 6. Choke System

C. DISASSEMBLY

1. Separation of Throttle and Fuel Bowl Bodies.

   a. Remove hex head plug and filter screen (if used) from side of throttle body.

   b. Remove four bowl to body screw and lockwasher assemblies.

   c. Raise throttle body slightly and separate gasket from fuel bowl flange, then lift off throttle body assembly being careful not to damage float assembly.

2. Disassembly of Throttle Body.

   a. Press screwdriver against float axle at slotted side of float hinge bracket and force axle through slotted side of bracket, then remove axle with fingers from opposite side of bracket and remove float assembly.

   b. Remove fuel valve needle, bowl to body gasket and venturi.

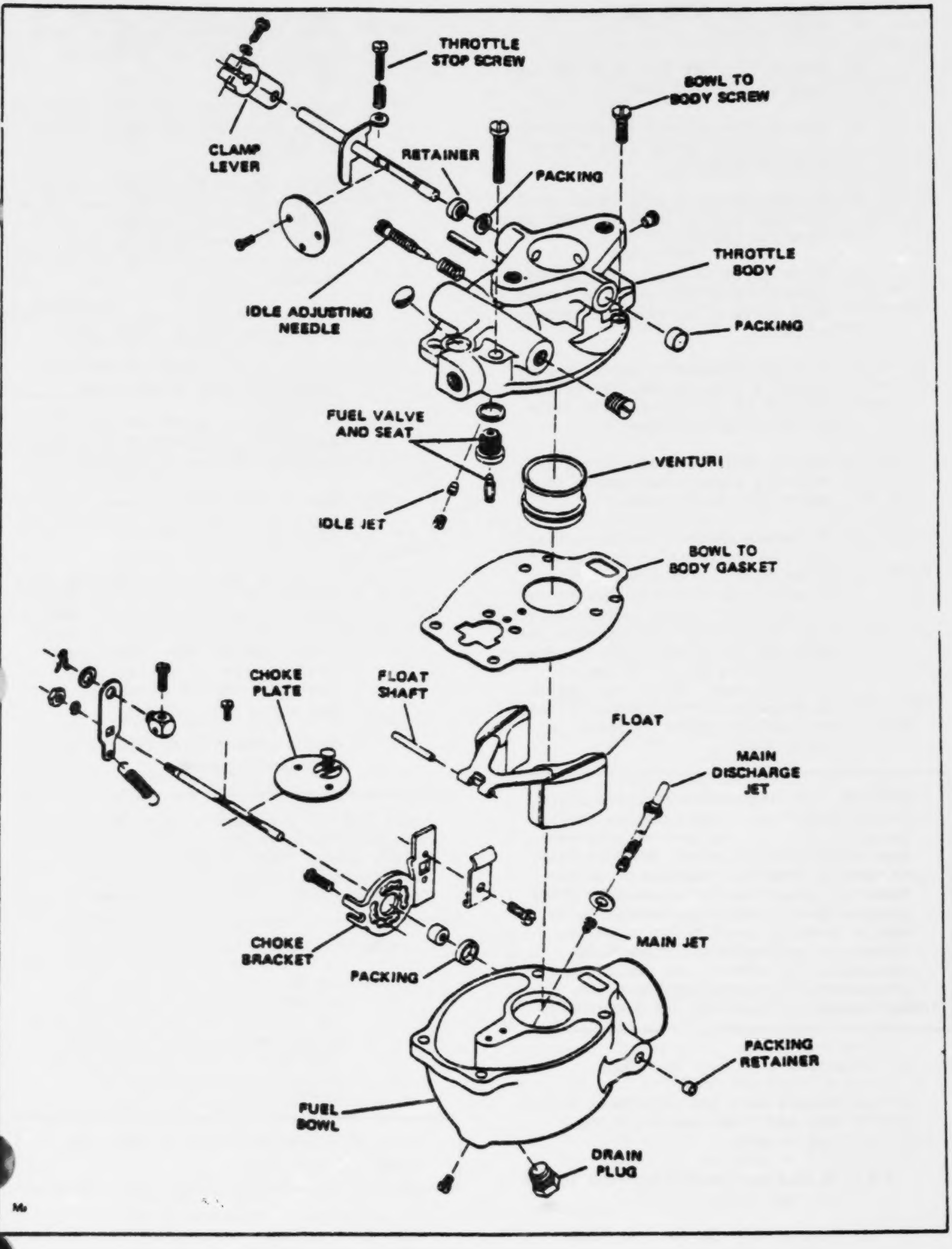

THROTTLE STOP SCREW
BOWL TO BODY SCREW
CLAMP LEVER
RETAINER
PACKING
THROTTLE BODY
IDLE ADJUSTING NEEDLE
PACKING
FUEL VALVE AND SEAT
VENTURI
IDLE JET
BOWL TO BODY GASKET
CHOKE PLATE
FLOAT SHAFT
FLOAT
MAIN DISCHARGE JET
MAIN JET
CHOKE BRACKET
PACKING
PACKING RETAINER
FUEL BOWL
DRAIN PLUG

Figure 7. Carburetor, Exploded View

c. Remove fuel valve seat and its fiber washer.

d. Remove idle jet from machined surface of throttle body.

e. Remove idle adjusting needle and its friction spring from side of throttle body.

f. Unscrew throttle stop screw until threaded end of screw is flush with throttle lever.

g. Close throttle and scribe across throttle body and throttle levers as a guide to correct reassembly of parts.

h. File off riveted or peened end of throttle plate screws, being careful not to damage throttle plate or throttle body bore.

i. Remove throttle plate screws and throttle plate; then remove throttle shaft and lever assembly.

j. To remove throttle shaft packing and packing retainer from throttle shaft hole, screw a 5/16" fine thread taper tap into packing retainer until firmly seated. Insert long punch or rod in opposite shaft hole and drive punch against end of tap until retainer is free of throttle body. Remove tap and repeat operation for removal of packing and retainer from opposite shaft hole.

NOTE: Do not disassemble throttle plate, throttle shaft and stop lever assembly, throttle packings and packing retainers from throttle body unless throttle shaft is bent or otherwise damaged or unless there is damage or visible wear to other components of throttle assembly. Do not remove throttle shaft bushings unless inspection indicates replacement is necessary. For removal and replacement of throttle shaft bushings refer to Replacement of Bushings and Reassembly.

3. Disassembly of Fuel Bowl Body

a. Remove main jet adjustment assembly and fiber washer, using a 1/2" wrench.

b. Remove hex drain plug from bottom of fuel bowl.

c. Remove main jet and its fiber washer.

d. Remove main discharge jet and its fiber washer from center of large opening in machined surface of fuel bowl.

e. Remove well vent jet from center of large opening in machined surface of fuel bowl.

f. Scribe across air intake section, choke bracket and choke lever as a guide to correct reassembly of parts, then remove choke lever spring from choke lever and choke bracket.

g. Remove choke shaft nut and its lockwasher then remove choke lever.

h. Remove choke bracket screws and lockwashers and remove choke bracket.

i. Remove choke shaft hole plug from opposite side of air intake.

j. Remove choke plate screws, choke plate and choke shaft from air intake section.

k. To remove choke shaft packing and packing retainer from choke shaft holes, screw a 5/16" fine thread taper into packing retainer until firmly seated. Then insert long punch against end of tap until retainer is free of air intake body. Remove tap from retainer.

l. Remove choke lever, taper pin and then remove lever.

NOTE: Do not disassemble choke assembly bracket, choke levers, shaft and choke plate unless there is damage to any of above parts or damage to any of the other component parts of the assembly.

m. Thoroughly clean all metal parts in Bendix Metalclene or Speedclene (or equivalent) and rinse in solvent. Blow out all passages and channels in the castings with compressed air. Reverse the air flow through each passage to insure the removal of all dirt particles.

CAUTION: NEVER USE A-WIRE OR DRILL TO CLEAN OUT THE JETS.

that are damaged or worn. Replace throttle shaft if shaft is bent or if shaft shows evidence of wear on the bearing surfaces. Replace throttle shaft bushings if a new shaft has more than .005" side play. Always use the correct Allis-Chalmers Repair Kit. For correct Repair Kit, refer to Parts Manual. Follow procedure outlined below for Removal and Replacement of Throttle Shaft Bushings.

D. REASSEMBLY

1. Removal and Replacement of Throttle Shaft Bushings.

> NOTE: Do not remove throttle shaft bushings unless new shaft bushings are available along with Bushing Driver and Line Reamer.

a. To remove throttle shaft bushing, screw a 3/8" taper tap into bushing at one end of throttle shaft bore until firmly seated in bushing. Then insert long punch or rod in opposite shaft hole and drive punch against end of tap until bushing is free of throttle body. Remove bushing from tap.

b. Repeat above operation to remove bushing from opposite shaft hole

c. To install throttle shaft bushing, place new throttle shaft bushing on bushing driver with taper end of bushing away from shoulder of driver. Start bushing into shaft hole and drive bushing in until bottomed, using a light hammer.

d. Repeat this operation to install bushing in opposite shaft hole.

e. Line ream the two shaft bushings, using line reamer.

2. Assembly of Fuel Bowl Body

a. Insert packing in open side of packing retainer and place assembly on bushing driver with packing facing small end of driver.

b. Insert small end of driver into choke shaft hole; start retainer into counterbore in body and lightly drive retainer into body until flush with machined surface.

c. Insert choke shaft or choke shaft and lever, as the case may be, into the air intake and install choke plate in same position in air intake with poppet valve facing the same way as it was before disassembly.

d. Align holes in plate with holes in shaft and install choke plate screws, leaving screws loose. Close choke for best closing and then tighten screws, using a small screwdriver.

e. Install choke shaft hole plug or install choke lever with taper pin if carburetor includes lever.

f. Place choke bracket in position on air intake with bracket aligned to scribe marks and attach bracket with screws and lockwashers.

g. Place choke lever on choke shaft, close choke and position lever to align with scribe marks. Then assemble choke shaft nut and lockwasher and securely tighten nut.

h. Attach choke lever spring to choke bracket and to choke lever.

i. Install main discharge jet and fiber washer in fuel bowl and tighten jet firmly.

j. Install well vent jet in fuel bowl and tighten, using a small screwdriver.

k. Place fiber washer on main jet and install jet in threaded opening at side of fuel bowl.

l. Install main jet adjustment and fiber washer or main passage plug, as the case may be, in threaded passage at side of fuel bowl.

3. Assembly of Throttle Body

a. Insert packing in open side of packing retainer and place assembly on bushing driver with packing facing small end of driver.

b. After inserting small end of driver into throttle shaft hole, start retainer into counterbore in throttle body until flush with machined surface or slightly below surface to avoid striking throttle lever.

c. Insert throttle shaft and lever assembly in throttle body. Rotate shaft to wide open; then insert throttle plate in shaft and rotate to close position, holding plate in position with fingers. Make certain beveled sides of plate fit against throttle bore when plate is closed.

d. Start throttle plate screws, leaving screws loose. Close throttle plate several times, making sure plate is centered in throttle bore. Then tighten screws, using small screwdriver.

e. Install idle adjusting needle and friction spring in threaded passage at side of throttle body. Turn needle in lightly against its seat, then back out needle 1-1/4 turns as a preliminary adjustment.

f. Install idle jet in machined surface of throttle body.

g. Install fuel valve seat and fiber washer.

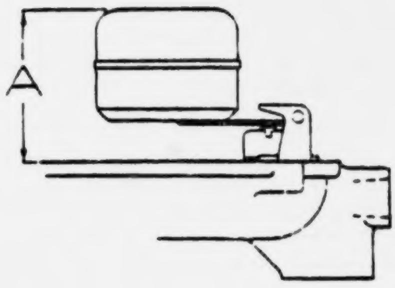
h. Install venturi in throttle bore, large opening end first. Then place new bowl to body gasket on machined surface of throttle body, making sure venturi flange is set in throttle body recess below gasket.

i. Install fuel valve needle in seat and position float assembly in hinge bracket.

j. Insert float axle through hinge bracket and float lever bushing from side opposite slot in hinge bracket with fingers only. Then press float axle through slotted side of bracket, using handle of screwdriver.

k. To insure correct fuel level in the float chamber, check distance "A" from top of floats to machined surface of throttle body (no gasket) with throttle body inverted, see Figure 8. This dimension should be 1-5/32" plus or minus 1/32". To increase or decrease distance from top of float bodies to machined surface, use long nose pliers and bend lever close to float body.

NOTE: Do not bend, twist or apply pressure on the float bodies. The float bodies when viewed from the free end of the bodies must be centered and at right angles to the machined surface and must move freely on the float axle.



MAT 74708 - 74708-1

Figure 8. Float Setting

4. Assembly of Throttle and Fuel Bowl Bodies

   a. Place fuel bowl assembly in position on throttle body, being careful not to damage floats. Then align holes in fuel bowl with holes in gasket and throttle body.

   b. Install four bowl to body screw and lockwasher assemblies and tighten throttle body.

   c. Install hex head plug and filter screen (if used) in threaded passage in throttle body.

   d. With throttle held in closed position, turn throttle stop screw in until stop screw just contacts throttle stop and then turn stop screw IN 1-1/2 additional turns as a preliminary idle speed setting.

TOPIC 5. ACCELERATOR LINKAGE

A. DESCRIPTION

The accelerator linkage provides manual, foot pedal control of the engine speed by either increasing or decreasing the fuel flow to the carburetor. Maximum engine speed, r.p.m., is controlled by the governor assembly, which is pre-adjusted at the factory.

B. MAINTENANCE AND ADJUSTMENT

Inspect linkage for security of mounting, presence of pins, spring tension and proper action.

Periodically lubricate moving parts of linkage, except shaft mounting blocks.

Adjustment of linkage may become necessary because of improper spring action, bent parts or replacement parts.

1. Ensure that all mechanical connections are securely made, as indicated in accelerator and linkage exploded view, Figure 9.

2. Inspect carburetor throttle lever position; throttle should be in fully CLOSED position with accelerator pedal released.

3. Have assistant push fully downward on the accelerator pedal; accelerator rod will pull adjustable yoke, attached to throttle lever, (overcoming pressure of CLOSED throttle return spring), and carburetor throttle will OPEN fully.

4. Release pedal. Throttle should now be fully CLOSED. Adjust accelerator cable throttle yoke IN or OUT to ensure a fully CLOSED condition (with accelerator pedal released).

5. Turn accelerator pedal stop screw IN or OUT and tighten locknut to adjust pedal to desired pedal release height.

C. PEDAL AND LINKAGE REMOVAL

1. Pedal. Remove "E" clip from pedal hinge pin, slide pin out of pedal and bracket and remove pedal (Figure 9).

2. Shaft Roller. Remove nut and lockwasher from bearing capscrew, and remove capscrew, bearing and two plain washers.

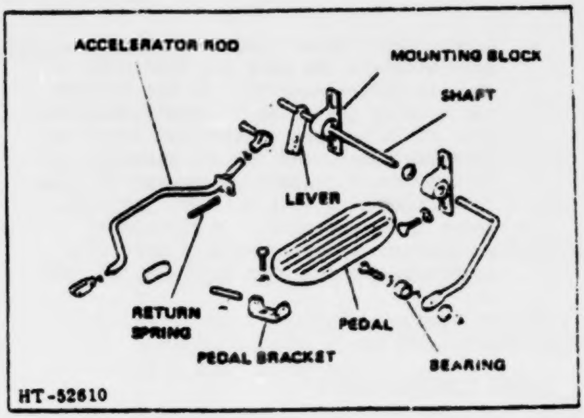


Figure 9. Accelerator and Linkage

3. Accelerator Shaft. Remove capscrews and lockwashers which attach shaft mounting blocks to front panel and remove assembly from truck. To remove mounting blocks, remove roll pin from accelerator lever and shaft. Slide lever and mounting blocks off shaft.

4. Accelerator cable. Remove accelerator cable return spring from spring clip. Remove nuts and lockwashers from all joints at accelerator lever and throttle lever and remove cable. Ball joints can be removed from cable by loosening jam nuts and turning ball joints off. The spring clip can be removed by removing one of the jam nuts.

D. PEDAL AND LINKAGE INSTALLATION

1. Accelerator Shaft. Place mounting blocks on accelerator shaft, separated by a washer. Move one mounting block and washer towards pedal end of shaft and install roll pin near center of shaft. Place accelerator lever on shaft and secure with roll pin. Install shaft assembly on front panel by securing mounting blocks with capscrews and lockwashers. After installation make sure shaft moves freely.

2. Shaft Roller. When installing accelerator shaft roller, place washers on each side of roller to ensure free rolling.

3. Pedal. If removed, install pedal bracket on toe plate. Insert accelerator pedal in bracket and install hinge pin and "E" clip.

4. Accelerator Cable. Locate yokes at approximately the same position they were in before removal. Do not tighten jam nuts at this time. Install accelerator cable between accelerator lever and throttle lever, and install nuts and lockwashers. Install return spring. Before tightening yoke nuts and jam nuts, refer to Paragraph B, for adjustment procedure. After linkage is correctly adjusted, tighten yoke nuts and jam nuts.

E. CHOKE CONTROL CABLE

1. Choke control is flexible cable type mounted on instrument panel and connected to a bracket and carburetor choke valve lever. Wire part on instrument panel. Since there is no return spring on choke valve lever, button can be moved in or out and remain in any position.

2. Choke control can be removed by removing locknut in back of instrument panel, removing three clamps, and disconnecting cable at choke valve lever and bracket. Pull choke control out of instrument panel.

TOPIC 19. GOVERNOR (TYPE II)

A. DESCRIPTION

A camshaft gear governor (Fig. 19-1) is used on the engine. The governor is a variable speed type and is sealed, dust proof and engine lubricated. A control shaft floats on two needle bearings mounted in the front cover. Close, accurate control of speed is provided through the complete power range. And idle surge adjustment screw provides pressure against the race assembly to eliminate any tendency of the engine to surge.

The governor consists of ten hardened steel balls riding in races in the driver assembly located in the camshaft gear. The driver assembly is locked to the camshaft with a lock nut. A gear on the crankshaft drives the camshaft gear. As the camshaft gear rotates the balls are forced outward by centrifugal force and against the race assembly. When the engine speed increases this force increases until a balanced condition between the governor rod spring and the governor lever exists. This action holds the engine at a constant speed.

The governor spring (Fig. 19-2) applies tension to the governor lever to force it toward the open throttle or increased speed position. This tension is counteracted by the balls in the governor acting against the race assembly. Adjustment is obtained by increasing or decreasing the tension the governor spring imposes on the governor lever.

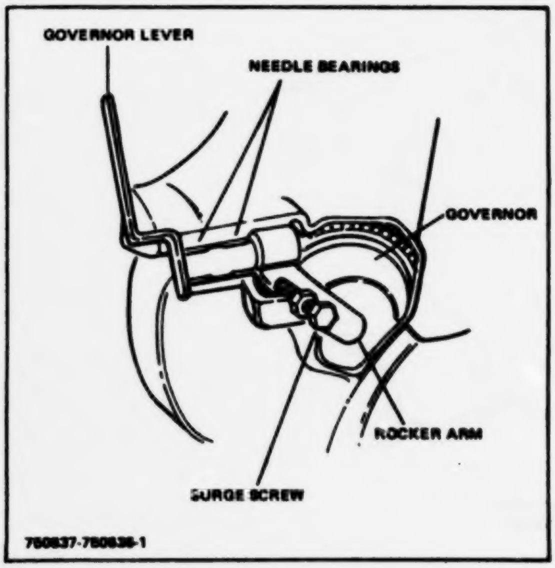


Figure 19-1. Governor - Cutaway View

B. ADJUSTMENT

The governor should be adjusted to maintain a high idle speed of 2550 ± 50 engine RPM.

1. Start engine and run until engine reaches normal operating temperature.
2. With choke completely open, back out surge adjusting screw (Fig. 19-2) so it will have no effect.
3. With engine idling under no load loosen lock nut on eyebolt holding governor spring to bracket. Turn lower nut counterclockwise to increase idle speed and clockwise to decrease speed.
4. When speed is adusted to correct RPM, tighten lock nut.

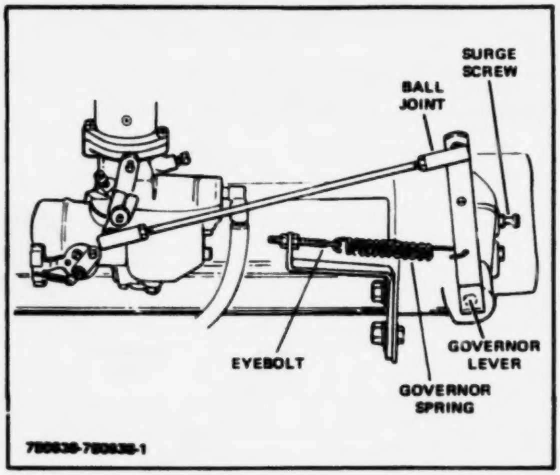


Figure 19-2. Governor Adjustment

5. Apply the desired load to the engine and check rpm. Loosen lock nut and adjust governor spring tension as above to increase or decrease speed. Tighten lock nut to hold adjustment.
6. Release the load and depress accelerator to run at governed speed, no load. If a surge is noted at no load, loosen lock nut and turn surge adjusting screw clockwise a turn at a time until surge is eliminated. Do not adjust surge screw to increase the no load speed more than a few RPM if at all. Tighten lock nut.

7. Check idle speed at no load again and adjust if necessary.

8. Check all lock nuts and tighten to hold correct adjustment.

C. REMOVAL

1. Loosen governor spring lock nut on eyebolt and disconnect spring from governor lever.

2. Disconnect ball joint from governor lever.

3. Remove drive belt from fan drive pulley and remove adapter and pulley from gear cover.

4. Remove capscrews holding gear cover to cylinder block. Pull gear cover away from the cylinder block about one-half inch to clear block. Move gear cover to the left and away to clear camshaft gear and remove gear cover. Remove gasket.

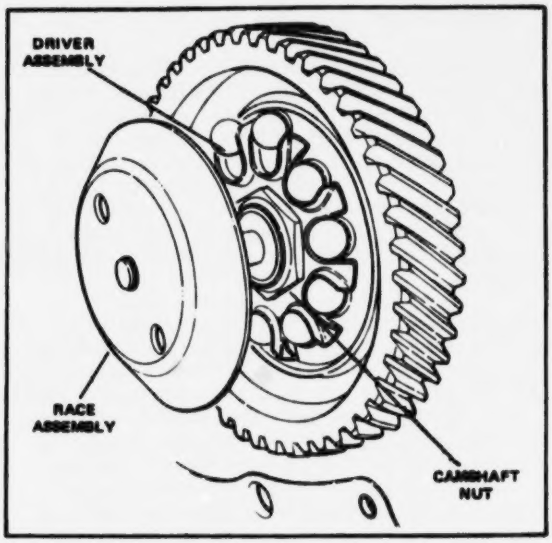

DRIVER ASSEMBLY
RACE ASSEMBLY
CAMSHAFT NUT

Figure 19-3. Governor

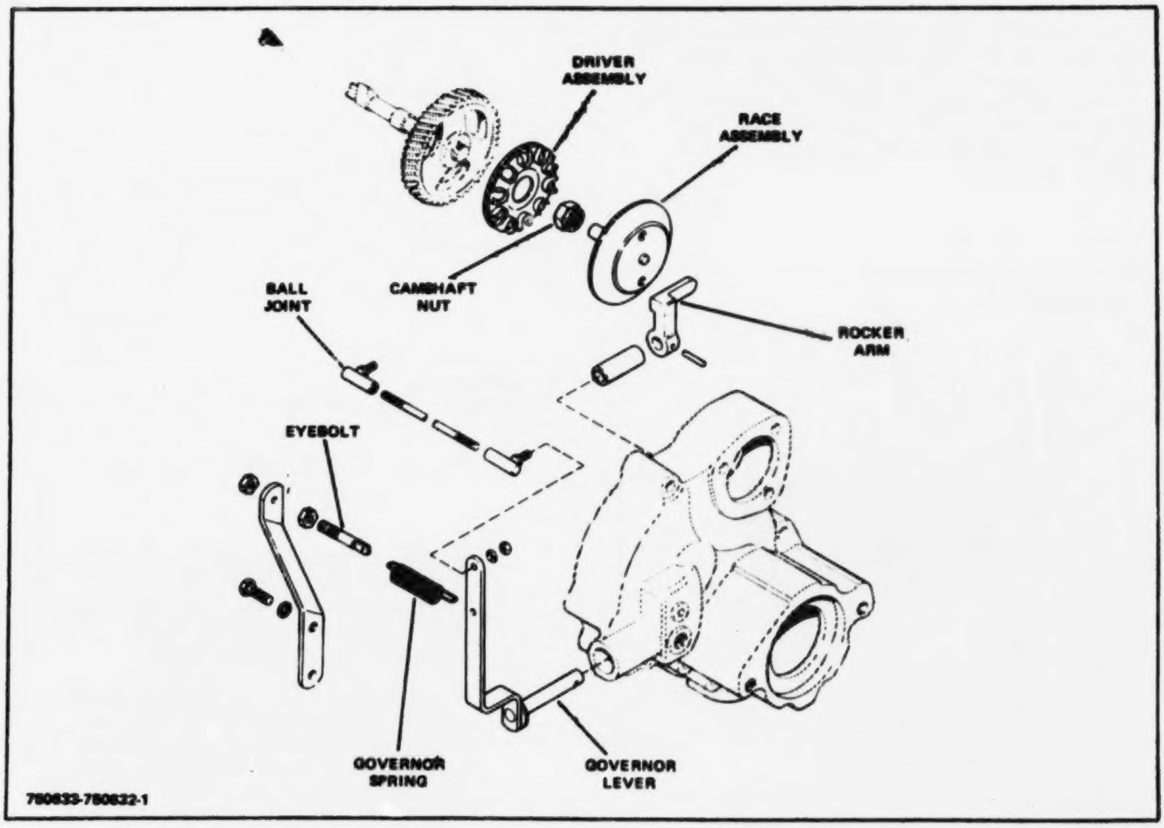

DRIVER ASSEMBLY
RACE ASSEMBLY
BALL JOINT
CAMSHAFT NUT
ROCKER ARM
EYEBOLT
GOVERNOR SPRING
GOVERNOR LEVER
780833-780832-1

Figure 19-4. Governor Assembly, Exploded View

5. To remove governor lever, remove pipe plug mounted below surge screw. Use a brass drift and drive pin from governor lever and race assembly lever. Remove governor lever from gear cover. Inspect needle bearings in gear cover for wear and damage.

6. Pull race assembly from camshaft (Fig. 19-3). Inspect balls in driver assembly.

7. If necessary, remove camshaft nut and remove driver assembly and balls.

D. INSTALLATION

1. Install driver assembly (Fig. 19-4) and balls on camshaft and camshaft gear. Secure with camshaft nut. Torque nut to 175-180 lb. ft.

2. Install race assembly (Fig. 19-3) by inserting shaft into bore of camshaft.

3. Install governor lever (Fig. 19-4) through needle bearings (Fig. 19-1) in gear cover. Install rocker arm (Fig. 19-4) on lever shaft and drive pin through lever and shaft.

4. Install new gasket on cylinder block and install gear cover on block. Lift gear cover into position and move to the left to clear camshaft gear and slide gear cover into position.

5. Secure gear cover with capscrews and washers.

6. Connect ball joint (Figure 19-2) to governor lever. Connect governor spring to eyebolt in bracket.

7. Install fan drive adapter and pulley on gear cover. Fan drive gear must mesh with camshaft gear.

8. Secure adapter to cover with capscrews and washers. Short capscrew must be installed in upper right hand hole.

9. Install fan belt on fan drive pulley, alternator pulley and water pump pulley. Adjust belt tension.

10. Operate engine and adjust speed with governor as described in B. Adjustment.

TOPIC 7. AIR CLEANER

NOTE: For air cleaner service see page 2-16.

A. MAINTENANCE-FREE BATTERY

Maintenance-Free batteries are sealed and do not need water added to their cells. The vents in the battery case must be kept clear (Fig. 1-1) and the terminal connections must be tight and clean.

The test indicator (Fig. 1-2) reveals the battery's state of charge. If the green dot is visible in the test indicator (Fig. 1-2) the battery is charged and in good condition. If the indicator is all dark (Fig. 1-2) the battery is in the need of charging.

> **WARNING**
>
> If the indicator turns light yellow, the electrolyte level is low due to prolonged use or overcharging. DO NOT attempt to test, charge or jump a Maintenance-Free battery if the test indicator has turned yellow. Discard the battery and check the truck charging circuit for proper operation.

NOTE: For accurate test indicator results, the battery should be level and the indicator wiped clean.

> **CAUTION**
>
> When connecting a booster battery connect the positive battery terminals with a jumper cable. Connect one end of another cable to the negative terminal of the booster battery and the other end to a chassis ground at least 12" (305 mm) from the discharged battery. Do not allow the trucks to touch each other.

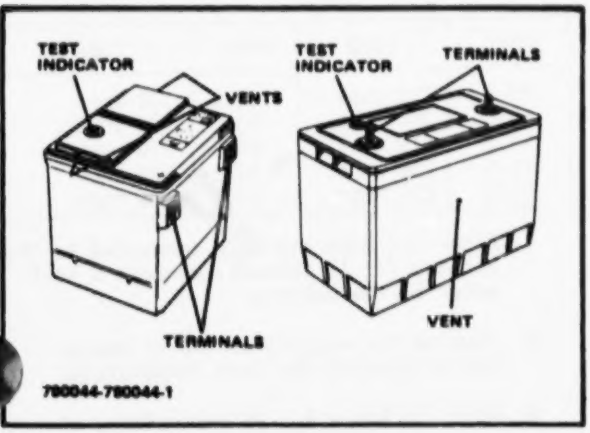


Figure 1-1. Maintemance-Free Batteries

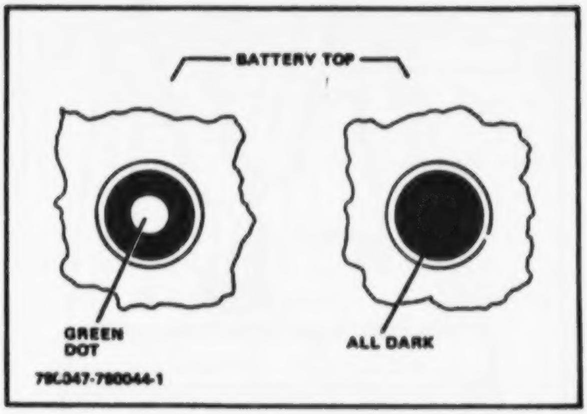


Figure 1-2. Test Indicator

> **CAUTION**
>
> When connecting a charger to the battery, connect the charger negative lead to the battery negative terminal, and the postive lead to the battery positive terminal. When connecting a charger to the top mounted terminal battery, make certain that the clamps are placed between the hex nuts and the terminal lead pads (Fig. 1-3). When connecting a charger to a battery with side mounted terminals the use of an adapter tool (available from Delco-Remy) is suggested (Fig. 1-4).
>
> When charging or jump starting, make sure that the ignition switch is in the OFF position and that all electrical accessories are turned off.

B. REMOVAL

1. Lift the operator's seat.
2. Gain access to the battery by swinging out the side panel.
3. Disconnect the positive and negative battery cable from the terminals.
4. Remove the wing nuts from the hold-down clamp.
5. Tilt the battery towards the rear of the truck and lift out of the battery tray.

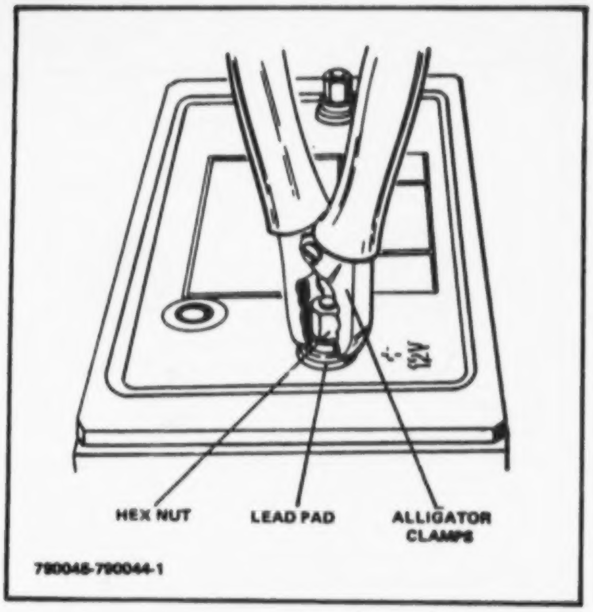

12V
HEX NUT
LEAD PAD
ALLIGATOR CLAMPS
790046-790044-1

Figure 1-3. Top Mounted Terminal Battery

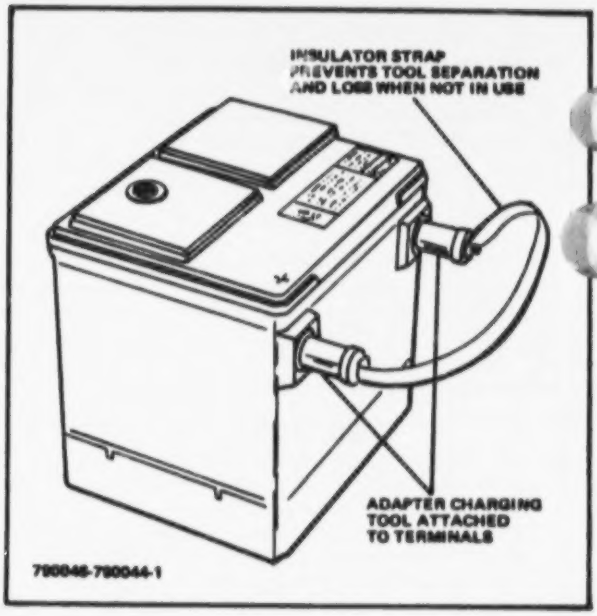

INSULATOR STRAP PREVENTS TOOL SEPARATION AND LOSS WHEN NOT IN USE
ADAPTER CHARGING TOOL ATTACHED TO TERMINALS
790046-790044-1

Figure 1-4. Side Mounted Terminal Battery

C. INSTALLATION

1. Keep the replacement battery in an upright position, tilting only as required for fit, during installation.
2. Be certain that the replacement battery is in the same position as the battery that was removed.
3. Make certain the battery posts and cable terminals are clean and that the terminals are connected to the proper posts.
4. Attach the terminals to the battery posts. Tighten the hardware on the side mount terminal battery to 6 lb. ft. (8 N·m). Tighten the nuts on top mounted batteries to 10-15 lb. ft. (13-20 N·m) of torque.

D. TESTING

1. Examine the test indicator on the top of the battery (Fig. 1-2). If a green dot is visible proceed to step three.
2. If the green dot is not visible, charge the battery, before proceeding with the test. Refer to Table 3.

NOTE: After charging connect a load of 300 amperes to the battery for 15 seconds before testing. This will remove the surface charge from the battery and will increase the accuracy of the test.

3. Connect a load as specified in Table 1. The load must be connected to the battery as specified in the table.

TABLE 1

MODEL	LOAD	MODEL	LOAD
49-5	210 amps	85-4	130 amps
55-5	180 amps	85-5	170 amps
59-5	210 amps	87-5	210 amps
71-5	230 amps	89-5	230 amps
81-5	230 amps	1200	235 amps

4. After the load has been connected to the battery for 15 seconds, connect a voltmeter to the battery.
5. Observe the reading on the voltmeter and disconnect the load immediately.
6. Refer to Table 2. If the voltage observed in step 5 above is acceptable the battery may be placed in service. If the voltage is not acceptable, the battery must be replaced.

TABLE 2

AMBIENT TEMPERATURE	(21°C) 70°F & Above	(16°C) 60°F	(10°C) 50°F	(4°C) 40°F	(-1°C) 30°F	(-7°C) 20°F	(-12°C) 10°F	(-18°C) 0°F
MINIMUM ACCEPTABLE VOLTAGE	9.6	9.5	9.4	9.3	9.1	8.9	8.7	8.5

E. CHARGING

1. Refer to A above for charger connection information.
2. Refer to Table 3 for charging information.

NOTE: Battery model numbers maybe found on the label on the top of the battery.

WARNING

DO NOT charge a battery if the test indicator is yellow.

WARNING

Charging operations must be temporarily halted if the battery case is hot (125°F) (55°C), or if gassing or spewing of electrolyte occurs.

TABLE 3

MODEL	SLOW CHARGING RATE	FAST CHARGING RATE
55-5 85-4 85-5	5A for 10 hrs 10A for 5 hrs	20A for 2.5 hrs 30A for 1.5 hrs
49-5 59-5 71-5 81-5 87-5 89-5 1200	5A for 15 hrs 10A for 7.5 hrs	20A for 3.75 hrs 30A for 2.5 hrs 40A for 2 hrs 50A for 1.5 hrs

NOTE: PAGES 3-75 THROUGH 3-80 ARE DELETED

A. DESCRIPTION

The alternator, Figures 2-1 and 2-2, contains a solid state regulator that is mounted inside the alternator slip ring end frame. All regulator components are enclosed into a solid mold, and this unit along with the brush holder assembly, is attached to the slip ring end frame. The regulator voltage setting never needs adjusting, and no provision for adjustment is provided.

The alternator rotor bearings contain a supply of lubricant sufficiently adequate to eliminate the need for periodic lubrication. Two brushes carry current through the two slip rings to the field coil mounted on the rotor, and under normal conditions will provide long periods of attention-free service.

The stator windings are assembled on the inside of a laminated core that forms part of the alternator frame. A rectifier bridge connected to the stator windings contains six diodes, and electrically changes the stator a.c. voltages to a d.c. voltage which appears at the alternator output (BAT) terminal. Alternator field current is supplied through a diode trio which also is connected to the stator windings. A capacitor, or condenser, mounted in the end frame protects the rectifier bridge and diode trio from high voltages, and suppresses radio noises.

No periodic adjustments or maintenance of any kind are required on the entire alternator assembly.

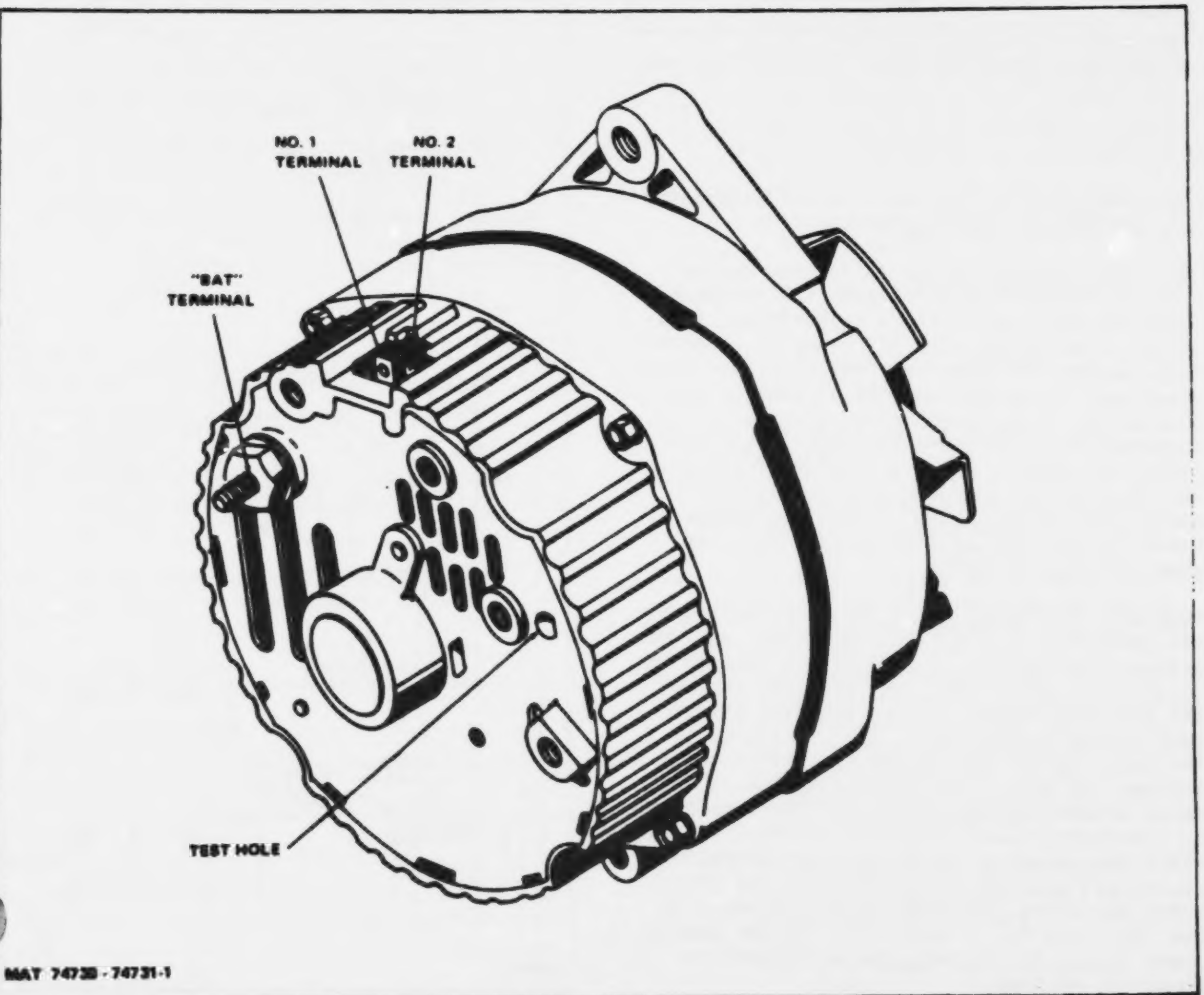


Figure 2.1. Alternator Assembly

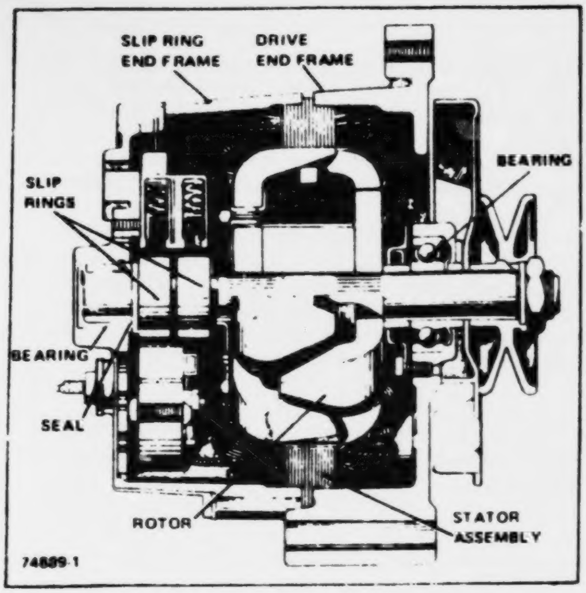


Figure 2-2. Cross-Sectional View of Alternator

B. PRINCIPLES OF OPERATION

The principles of operation of the alternator are as follows. See Figure 2-3.

When the ignition switch is closed, current from the battery flows through the 10-ampere fuse and resistor to the alternator No. 1 terminal, through resistor R1, diode D1, and the base-emitter to transistor TR1 to ground, and then back to the battery. This turns on transistor TR1, and current flows through the alternator field coil and TR1 back to the battery. The ammeter shows discharge. The resistor in parallel with the ammeter reduces total circuit resistance to provide higher field current for initial voltage build-up when the engine starts.

With the alternator operating, a.c. voltages are generated in the stator windings, and the stator supplies d.c. field current through the diode trio, the field, TR1, and then through the grounded diodes in the rectifier bridge back to the stator. Also, the six diodes in the rectifier bridge change the stator a.c. voltages to a d.c. voltage which appears between ground and the alternator "BAT" terminal. As alternator speed increases, current is provided for charging the battery and operating electrical accessories. Also, with the alternator operating, the same voltage appears at the "BAT" and No. 1 terminals, and the ammeter shows charge to indicate the alternator is producing voltage.

The No. 2 terminal on the alternator is always connected to the battery, but the discharge current is limited to a negligible value by the high resistance of R2 and R3. As the alternator speed and voltage increase, the voltage between R2 and R3 increases to the point where zener diode D2 conducts. Transistor TR2 then turns on and TR1 turns off. With TR1 off, the field current and system voltage decrease, and D2 then blocks current flow, causing TR1 to turn back on. The field current and system voltage increases, and this cycle then repeats many times per second to limit the alternator voltage to a preset value.

Capacitor C1 smooths out the voltage across R3, resistor R4 prevents excessive current through TR1 at high temperatures, and diode D3 prevents high-induced-voltages in the field windings when TR1 turns off. Resistor R2 is a thermistor which causes the regulated voltage to vary with temperature, thus providing the optimum voltage for charging the battery.

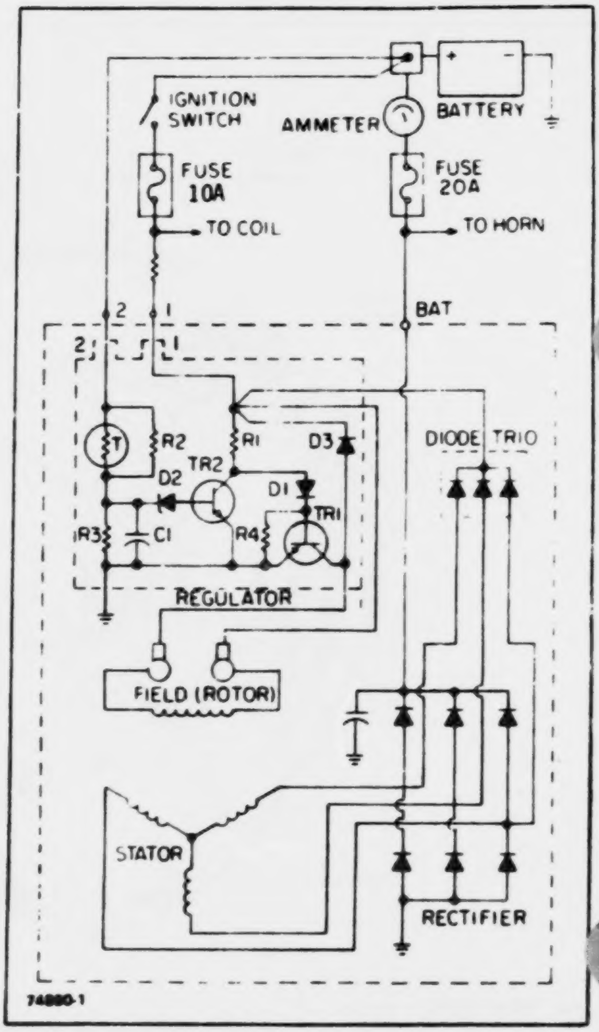


Figure 2-3. Alternator Internal Circuits, Schematic Diagram

C. TROUBLESHOOTING PROCEDURES

Close adherence to the following procedures in the order presented will lead to the locations of charging system defects in the shortest possible time. Only a portion of those procedures need be performed. It will never be necessary to perform all the procedures in order to locate the trouble.

A basic wiring diagram showing lead connections is shown in Figure 2-4. To avoid damage to the electrical equipment, always observe the following precautions:

1. Do not polarize the alternator.
2. Do not short across or ground any of the terminals in the charging circuit except as specifically instructed herein.
3. NEVER operate the alternator with the output terminal open-circuited.
4. Make sure the alternator and battery have the same ground polarity.
5. When connecting a charger or a booster battery to the vehicle battery, connect negative to negative and positive to positive.

Trouble in the charging system will show up as one or more of the following conditions:

1. Faulty ammeter operation.
2. An undercharged battery as evidenced by slow cranking and low specific gravity readings.
3. An overcharged battery as evidenced by excessive water usage.

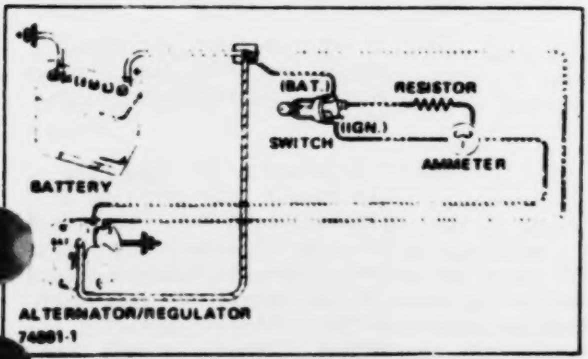


Figure 2-4. Alternator Typical Wiring Diagram

1. Undercharged Battery

This condition, as evidenced by slow cranking and low specific gravity readings, can be caused by one or more of the following conditions, even though the ammeter may be operating normally.

a. Insure that the undercharged condition has not been caused by accessories having been left on for extended periods.

b. Check the drive belt for proper tension.

c. If a battery defect is suspected, check the battery as described in the Battery Service section.

d. Inspect the wiring for defects. Check all connections for tightness and cleanliness, including the slip connectors at the alternator and firewall, and the cable clamps and battery posts.

e. With ignition on and all wiring harness leads connected, connect a voltmeter from:

alternator "BAT" terminal to ground,

alternator No. 1 terminal to ground, and

alternator No. 2 terminal to ground.

A zero reading indicates an open between voltmeter connection and battery. The alternator has a built-in feature which avoids overcharge and accessory damage by preventing the alternator from turning on if there is an open in the wiring harness connected to the No. 2 terminal. Opens in the wiring harness connected between the No. 2 terminal and battery may be between the terminals, at the crimp between the harness wire and terminal, or in the wire.

f. If previous Steps a. through e. check satisfactorily, check the alternator as follows:

(1) Disconnect battery ground cable.

(2) Connect an ammeter in the circuit at the "BAT" terminal of the alternator

(3) Reconnect battery ground cable.

(4) Connect a carbon pile across the battery.

(5) Operate engine at moderate speed as required, and adjust carbon pile as required, to obtain maximum current output.

(6) If ampere output is within 10 amperes of rated output as stamped on alternator frame, alternator is not defective; recheck Steps a. through e.

(7) If ampere output is not within 10 amperes of rated output, ground the field winding by inserting a screwdriver into the test hole.

CAUTION: Tab in the alternator test hole is within .750" of casting surface. Do not force screwdriver deeper than one inch into end frame.

(8) Operate engine at moderate speed, as required, and adjust carbon pile as required to obtain maximum current output.

(9) If output is within 10 amperes of rated output, replace regulator as covered in Alternator Repair section, and check field winding.

(10) If output is not within 10 amperes of rated output, check the field winding, diode trio, rectifier bridge, and stator as covered in Alternator Repair section.

(11) Remove ammeter from alternator.

2. Overcharged Battery

a. To determine battery condition, check battery as indicated in Battery Service section.

b. Connect a voltmeter from alternator No. 2 terminal to ground. If reading is zero, No. 2 lead circuit is open.

c. If battery and No. 2 lead circuit check good, but an obvious overcharge condition exists as evidenced by excessive battery water usage, proceed as follows:

(1) Separate end frames as indicated in Alternator Repair - Disassembly section.

(2) Check field winding for shorts. See Figure 2-5. If shorted replace rotor and regulator.

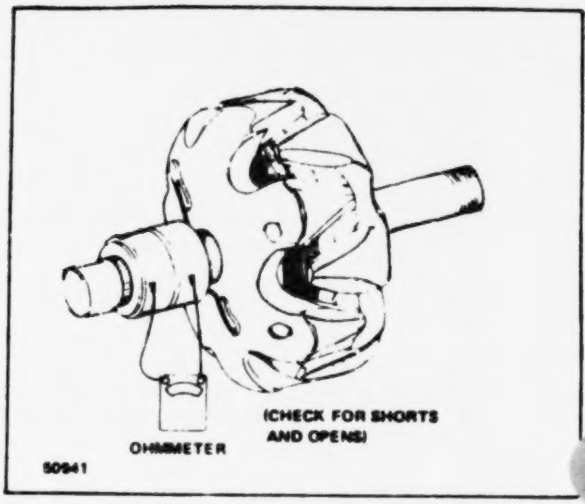


Figure 2-5. Checking Rotor Field Winding

(3) Check field winding for grounds. If grounded replace only the rotor.

(4) Connect ohmmeter, using lowest range scale, from brush lead clip to end frame as shown in Step 1, Figure 2-6, then reverse lead connections.

(5) If both readings are zero, either the brush lead clip is grounded or regulator is defective.

(6) A grounded brush lead clip can result from omission of insulating washer (Figure 2-6 omission of insulating sleeve over screw, or damaged insulating sleeve over screw, or damaged insulating sleeve. Remove screw to inspect sleev If satisfactory, replace regulator as indicated in Alternator Repair section.

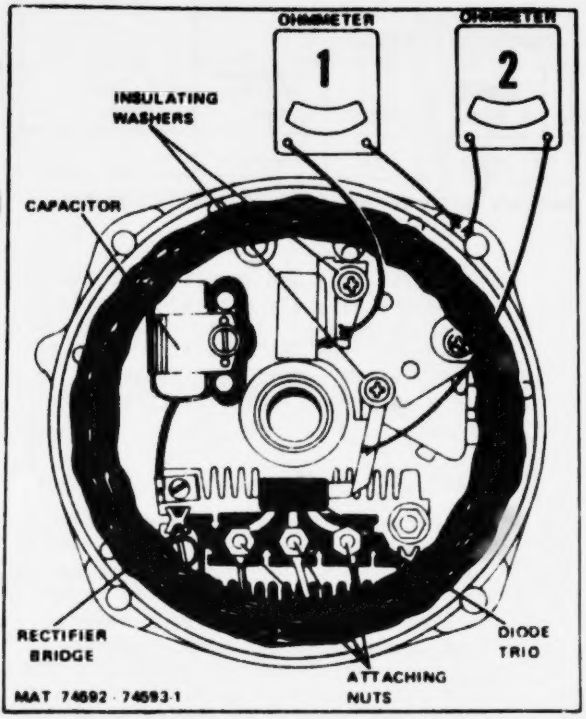


Figure 2-6. End Frame Assembly, Inside View

D. ADJUSTMENT

Be sure to check the mounting bolts for tightness and the belt for alignment, correct tension and wear. Belt tension should be adjusted to allow approximately .375" inward deflection of the belt between the alternator pulley and the fan pulley with a force of about 10 pounds. (See Figure 2-7)

When tightening belt tension always apply pressure against the stator laminations, never against the end frames. Inspect the brush springs and brushes for evidence of any damage, wear or corrosion. Replace any brush springs or brushes in doubtful condition.

A noisy alternator can be caused by worn or dirty bearings, loose mounting bolts, a loose drive pulley, a defective diode or a defective stator.

E. REMOVAL

Alternator: After extensive periods of operation or during major engine overhaul, the alternator should be removed from the truck for a thorough inspection and cleaning of all parts. The alternator consists of four main components which includes the two end frames, the stator and the rotor. The following procedures should be used for proper removal:

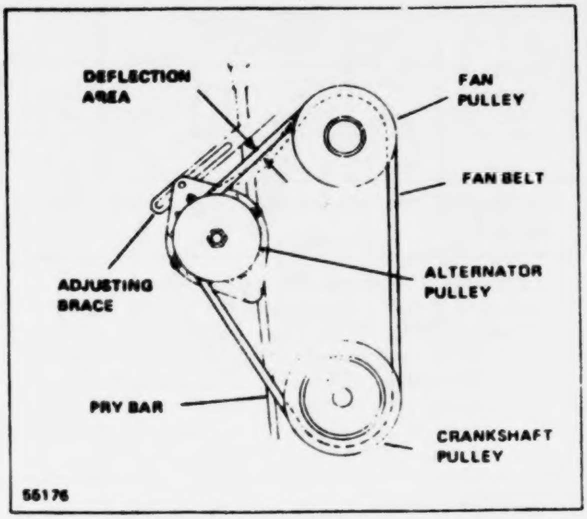


Figure 2-7. Fan Belt Tension

1. Disconnect the battery from the electrical circuit prior to alternator removal/installation.
2. Disconnect and properly label the "BAT" (Battery), No. 1 and No. 2 terminal leads at the alternator.
3. Loosen the adjusting brace and the pivot mounting bolt, then push alternator towards engine until fan belt is disengaged from the alternator pulley.
4. Carefully remove the alternator from the engine as the pivot mounting bolt and adjusting brace capscrew are removed.

F. SERVICE

Proceed according to the following sequence.

1. Disassembly

To disassemble the alternator, take out the four thru-bolts, and separate the drive end frame and rotor assembly from the stator assembly by prying apart with a screwdriver at the stator slot. A scribe mark will help locate the parts in the same position during assembly.

After disassembly, place a piece of tape over the slip ring end frame bearing to prevent entry of dirt and other foreign material, and also place a piece of tape over the shaft on the slip ring end. If brushes are to be reused, clean with a soft dry cloth.

ALTERNATOR SPECIFICATIONS

Rotation Viewing D.E.	Field Current (80°F.)			Cold Output at Specified Voltage					Rated Hot Output (Amps.)
	Grd.	Amps.	Volts	Spec. Volts	Amps.	Approx. RPM	Amps.	Approx. RPM	
CW	Neg.	4.0 - 4.5	12	*	22	2000	33	5000	37

***Voltmeter not needed for cold output check. Load battery with carbon pile to obtain maximum output.**

CAUTION: Use pressure sensitive tape, and not friction tape which would leave a gummy deposit on the shaft.

To remove the drive end frame from the rotor, place the rotor in a vise and tighten only enough to permit removal of the shaft nut.

CAUTION: Avoid excessive vise tightening as this may cause distortion of the rotor.

Remove the shaft nut, washer, pulley, fan, and the collar, and then separate the drive end frame from the rotor shaft.

2. Rotor Field Winding Checks

To check for opens, connect the test lamp or ohmmeter to each slip ring. If the lamp fails to light, or if the ohmmeter reading is high (infinite), the winding is open (Fig. 2-5).

Connect test lamp or ohmmeter from one slip ring to shaft. If lamp lights, or if reading is low, the rotor winding is grounded (not illustrated).

The winding is checked for short-circuits or excessive resistance by connecting a battery and ammeter in series with the edges of the two slip rings. Note the ammeter reading and refer to alternator specifications. As ammeter reading above the specified value indicates shorted windings; a reading below the specified value indicates excessive resistance.

An alternate method is to check the resistance of the field by connecting an ohmmeter to the two slip rings (Fig. 2-5). If the resistance reading is below the specified value, the winding is shorted; if above the specified value the winding has excessive resistance. The specified resistance value can be determined by dividing the voltage by the current given in alternator specifications. Remember that the winding resistance and ammeter readings will vary slightly with winding temperature changes. If the rotor is not defective, but the generator fails to supply rated output, the defect is in the diode trio, rectifier bridge, or stator.

3. Diode Trio Check

The diode trio is identified in Figure 2-6. First, connect an ohmmeter, using lowest range scale, from diode trio long connector to end frame as shown in Step 2, Figure 2-6; then, reverse lead connections. If both readings are the same, check for grounded brush lead clip caused by omission of insulating washer (Fig. 2-6), omission of insulating sleeve over screw, or damaged insulating sleeve. Remove screw to inspect sleeve. If screw assembly is correct, and both ohmmeter readings are the same, replace regulator.

To check the diode trio, remove it from the end frame assembly by detaching the three nuts, the attaching screw, and removing the stator assembly. Note that the insulating washer on the screw is assembled over the top of the diode trio connector. Use the lowest range of an ohmmeter having a 1-1/2 volt cell. Connect the ohmmeter to the single connector and to one of the three connectors (Figure 2-8). Observe the reading. Then, reverse the ohmmeter leads to the same two connectors. If both readings are the same, replace the diode trio. A good diode trio will give one high and one low reading. Repeat this same test between the single connector and each of the other two connectors. Also, connect the ohmmeter to each pair of the three connectors (not illustrated). If any reading is zero, replace the diode trio.

NOTE: Figures 2-6 and 2-8 illustrate two diode trios differing in appearance. Either one of these diode trios may be used in the alternator, since the two are completely interchangeable.

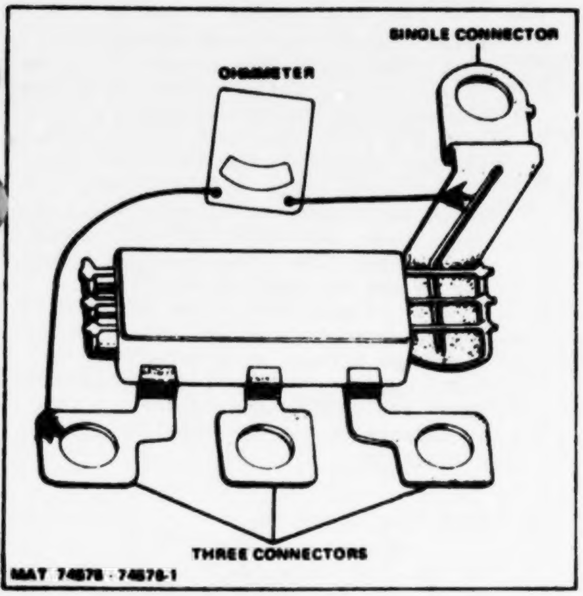

SINGLE CONNECTOR
OHMMETER
THREE CONNECTORS
MAT 74576 - 74576-1

Figure 2-8. Diode Trio Check

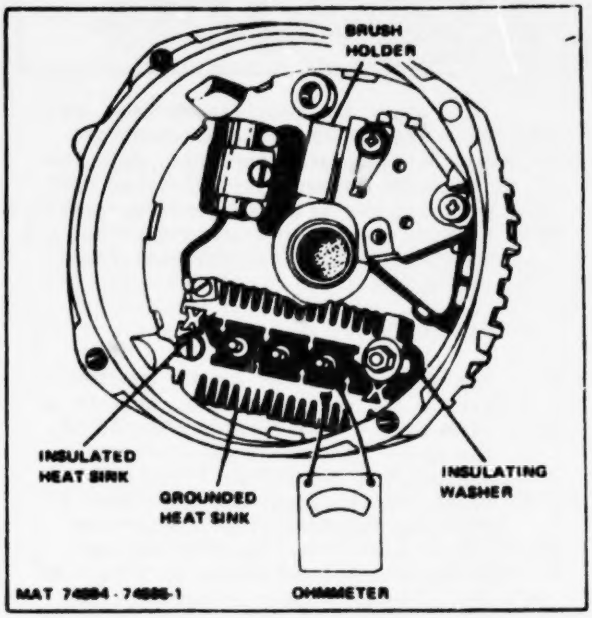

BRUSH HOLDER
INSULATED HEAT SINK
GROUNDED HEAT SINK
INSULATING WASHER
MAT 74584 - 74585-1
OHMMETER

Figure 2-9. Rectifier Bridge Check

4. Rectifier Bridge Check

Note that the rectifier bridge has a grounded heat sink and an insulated heat sink connected to the output terminal. Also, note the insulating washer located between the insulated heat sink and end frame.

To check the rectifier bridge, connect the ohmmeter to the grounded heat sink and one of the three terminals (Fig. 2-9). IMPORTANT: If rectifier bridge is constructed as shown in Figure 2-10, connect ohmmeter pressing down very firmly onto flat metal connector, and, not onto threaded stud as in Figure 2-9. Then reverse the lead connections to the grounded heat sink and same terminal. If both readings are the same, replace the rectifier bridge. A good rectifier bridge will give one high and one low reading. Repeat this same test between the grounded heat sink and the other two terminals, and between the insulated heat sink and each of the three terminals. This makes a total of six checks, with two readings taken for each check. The ohmmeter check of the rectifier bridge, and of the diode trio as previously covered, is a valid and accurate check. DO NOT replace either unit unless at least one pair of readings is the same.

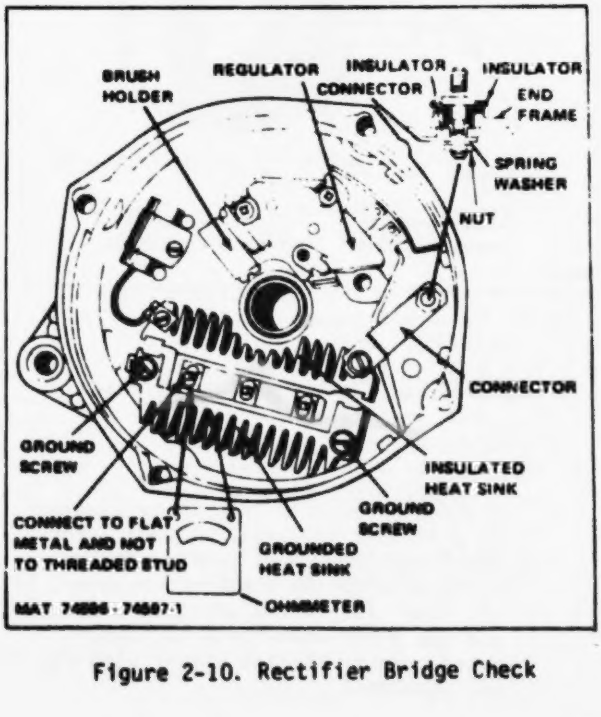

BRUSH HOLDER
REGULATOR
INSULATOR
CONNECTOR
INSULATOR
END FRAME
SPRING WASHER
NUT
CONNECTOR
GROUND SCREW
INSULATED HEAT SINK
GROUND SCREW
CONNECT TO FLAT METAL AND NOT TO THREADED STUD
GROUNDED HEAT SINK
MAT 74586 - 74587-1
OHMMETER

Figure 2-10. Rectifier Bridge Check

CAUTION: Do not use high voltage to check these units, such as a 110 volt test lamp.

To replace the rectifier bridge, remove the attaching screws, and disconnect the capacitor lead. Note the insulator between the insulated heat sink and end frame (Fig. 2-9). Rectifier bridges may vary in appearance but are completely interchangeable in these generators.

5. Stator Checks

The stator windings may be checked with a 110 volt test lamp, or with an ohmmeter. If the lamp lights, or if the meter reading is low when connected from any stator lead to the frame, the windings are grounded. If the lamp fails to light, or if the meter reading is high when successively connected between each pair of stator leads, the windings are open (Fig. 2-11).

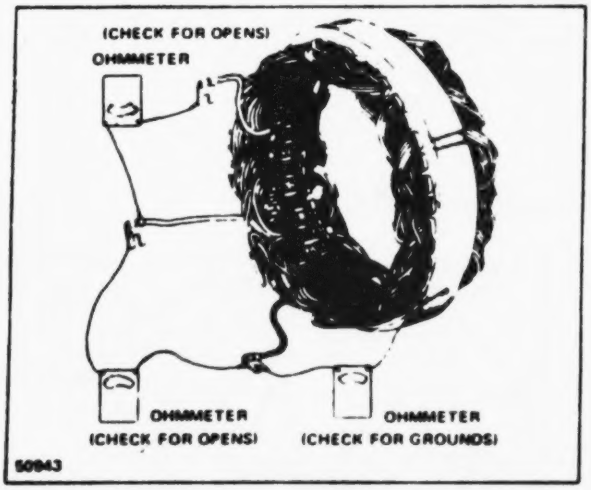


Figure 2-11. Checking Stator Windings

A short circuit in the stator windings is difficult to locate without laboratory test equipment due to the low resistance of the windings. However, if all other electrical checks are normal and the alternator fails to supply rated output, shorted stator windings are indicated.

6. Brush Holder and Regulator Replacement.

After removing the three attaching nuts, the stator, and diode trio screw (Figs. 2-9 and 2-10), the brush holder and regulator may be replaced by removing the two remaining screws. Note the two insulators located over the top of brush clips in Figure 2-6; these two screws have special insulating sleeves over the screw body above the threads. The third mounting screw may or may not have an insulating sleeve. If not, this screw must not be interchanged with either one of the other two screws, as a ground may result, causing no output or uncontrolled generator output. Regulators may vary in appearance but are completely interchangeable.

7. Slip Ring Servicing

If the slip rings are dirty, they may be cleaned and finished with 400 grain or finer polishing cloth. Spin the rotor, and hold the polishing cloth against the slip rings until they are clean.

CAUTION: The rotor must be rotated in order to clean the slip rings evenly. Cleaning the slip rings by hand without spinning the rotor may result in flat spots on the slip rings, causing brush noise.

Slip rings which are rough or out of round should be trued in a lathe to .002" maximum indicator reading. Remove only enough material to make the rings smooth and round. Finish with 400 grain or finer polishing cloth and blow away all dust.

8. Bearing Replacement and Lubrication

The bearing in the drive end frame can be removed by detaching the retainer plate screws, and then pressing the bearing from the end frame. If the bearing is in satisfactory condition, it may be reused, and it should be filled one-quarter full with Delco-Remy lubricant No. 1948791 before reassembly.

CAUTION: Do not overfill bearing as this may cause it to overheat. Use only 1948791 lubricant.

To install a new bearing, press in with a tube or collar that just fits over the outer race, with the bearing and slinger assembled into the end frame as shown in Figure 2-12. It is recommended that a new retainer plate be installed if the felt seal in the retainer plate is hardened or excessively worn. Fill the cavity between the retainer plate and bearing with 1948791 lubricant.

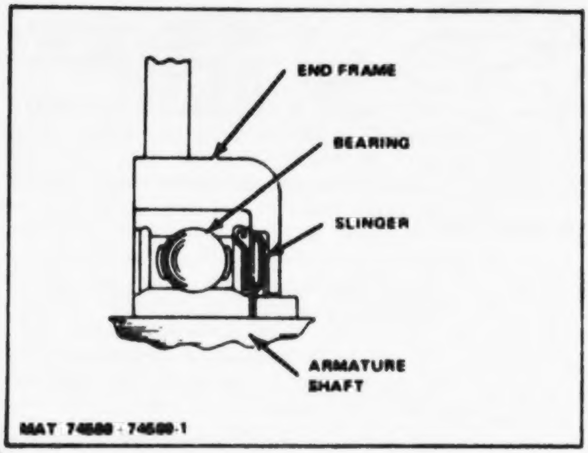


Figure 2-12. Drive End Bearing Assembly (Some models use flat washer instead of slinger)

The bearing in the slip ring end frame should be replaced if its grease supply is exhausted. No attempt should be made to re-lubricate and reuse the bearing. To remove the bearing from the slip ring end frame, press out with a tube or collar that just fits inside the end frame housing. Press from the outside of the housing towards the inside.

To install a new bearing, place a flat plate over the bearing and press in from the outside towards the inside of the frame until the bearing is flush with the outside of the end frame. Support the inside of the frame with a hollow cylinder to prevent breakage of the end frame. Use extreme care to avoid misalignment or otherwise placing undue stress on the bearing.

If the seal is separate from the bearing, it is recommended that a new seal be installed whenever the bearing is replaced. Press the seal in with the lip of the seal toward the rotor when assembled, that is, away from the bearing. Lightly coat the seal lip with oil to facilitate assembly of the shaft into the bearing.

9. Reassembly

Assembling the pulley assembly, remembering to secure the rotor in a vise only tight enough to permit tightening the shaft nut to 40-60 lb. ft. If excessive pressure is applied against the rotor, the assembly may become distorted. To install the slip ring end frame assembly to the rotor and drive end frame assembly, remove the tape over the bearing and shaft, and make sure the shaft is perfectly clean after removing the tape. Insert a pin through the holes to hold up the brushes. Carefully install the shaft into the slip ring end frame assembly to avoid damage to the seal. After tightening the thru-bolts remove the brush retaining pin to allow the brushes to fall down into the slip rings.

10. Alternator Bench Check

To check the alternator in a test stand, proceed as follows:

a. Make connections as shown in Figure 2-14, except leave the carbon pile disconnected. IMPORTANT: Ground polarity of battery and alternator must be the same. Use a fully charged battery, and a 10 ohm resistor rated at 6 watts or more between the alternator No. 1 terminal and the battery.

b. Slowly increase the alternator speed and observe the voltage.

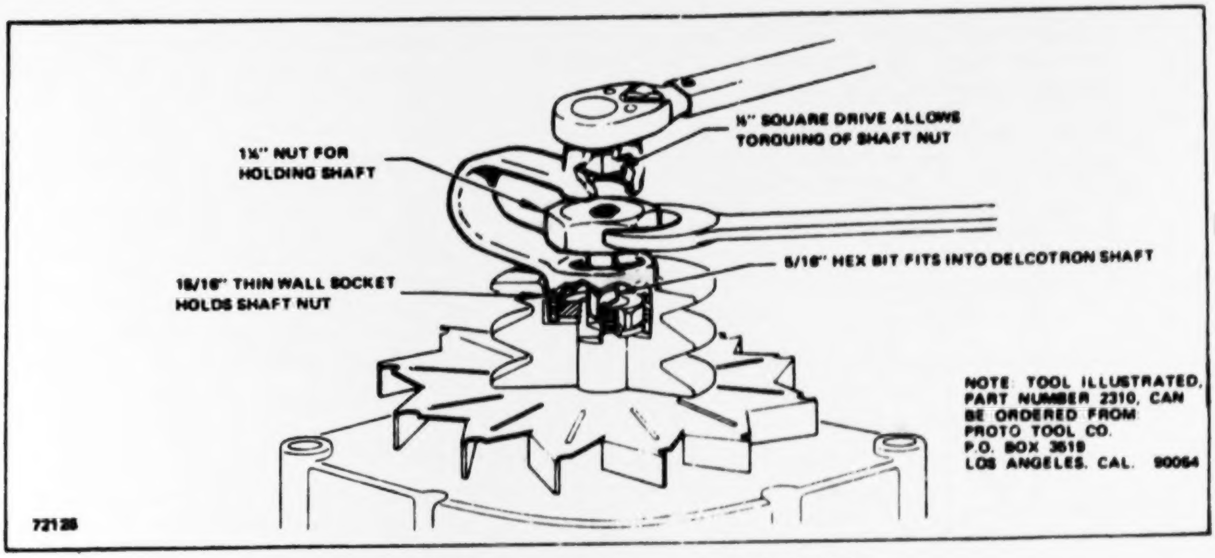

½" SQUARE DRIVE ALLOWS TORQUING OF SHAFT NUT
1¼" NUT FOR HOLDING SHAFT
5/16" HEX BIT FITS INTO DELCOTRON SHAFT
15/16" THIN WALL SOCKET HOLDS SHAFT NUT
NOTE: TOOL ILLUSTRATED, PART NUMBER 2310, CAN BE ORDERED FROM: PROTO TOOL CO. P.O. BOX 3619 LOS ANGELES, CAL. 90054
72128

Figure 2-13. Torquing Alternator Shaft Nut

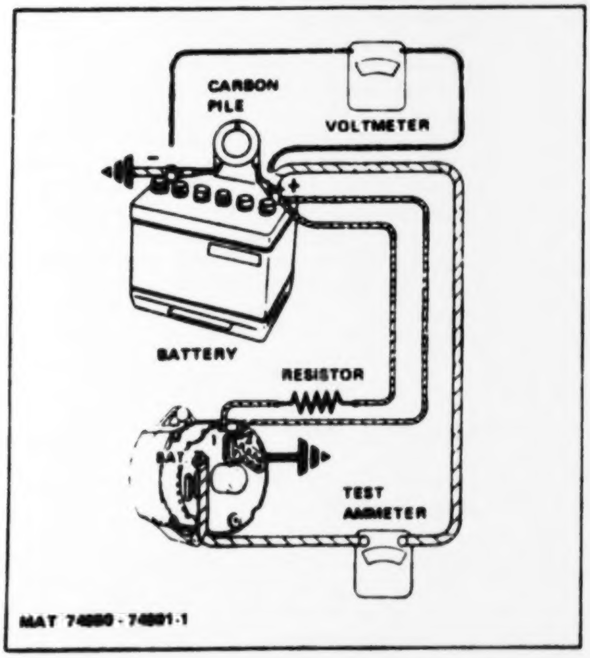

CARBON PILE
VOLTMETER
-
+
BATTERY
RESISTOR
BAT.
TEST AMMETER
MAT 74090 - 74091-1

Figure 2-14. Connections for Bench Check of Alternator (Negative ground alternator shown)

c. If the voltage is uncontrolled with speed and increases above 15.5 volts on the 12 volt system, check for a grounded brush lead clip as indicated in Overcharged Battery section, Step 3. If not grounded, replace the regulator, and check field winding.

NOTE: The battery must be fully charged when making this check.

d. If voltage is below 15.5 volts, connect the carbon pile as shown.

e. Operate the alternator at moderate speed, as required, and adjust the carbon pile, as required, to obtain maximum current output.

f. If output is within 10 amperes of rated output as stamped on alternator frame, alternator is good.

g. If output is not within 10 amperes of rated output, keep battery loaded with carbon pile, and ground alternator field (Fig. 2-4).

h. Operate generator at moderate speed and adjust carbon pile as required to obtain maximum output.

i. If output is within 10 ampere of rated output, replace regulator as indicated in Regulator Replacement section, and check field winding.

j. If output is not within 10 amperes of rated output, check the field winding, diode trio, rectifier bridge, and stator as previously described.

TOPIC 3. STARTER MOTOR

A. DESCRIPTION

[illegible]tarter motor is a series type field coil con[illegible]ection, four brush construction, with armature supported by bushings at drive and commutator ends. The two brushes connected to field coil leads are insulated in commutator end frame [illegible]d the two armature brushes are grounded.

CAUTION: Starter must never be used for more than 30 seconds at any one time. Allow starter motor to cool for 2 minutes before using again. Never use starter to move vehicle.

A solenoid switch mounted to the flange on the starter motor drive housing operates the overrunning clutch drive by means of linkage and a shift lever. When the starter switch closes the cranking circuit, the solenoid is energized, shifting the starter motor pinion into mesh with the engine flywheel ring gear and closing the main contacts located inside the solenoid. Battery current is then directed to the motor causing the armature to rotate. Cranking torque is transmitted by the clutch from the starter motor armature to the flywheel ring gear. To protect the armature from excessive speed as the engine starts, the [illegible]lutch is designed to "overrun" or turn [illegible]ster than the armature which permits the [illegible]nion to disengage itself.

B. MAINTENANCE

The starter motor is a completely enclosed unit and requires very little maintenance. However, to ensure satisfactory operation, periodic inspections should be made to make sure mounting and wiring connections are tight and in good condition. Solenoid switch should be firmly mounted and all wiring connections should be clean and tight. These inspections should also include connections to battery and return circuit, loose or dirty connections anywhere in the circuit will cause high resistance and reduced cranking efficiency. When mounting and wiring connections are kept in good condition, and motor responds instantly and cranks engine when switch is closed, motor may be considered to be in satisfactory condition and disassembly is unnecessary.

[illegible]rter motor under normal operating conditions [illegible]l not require lubrication except during [illegible]verhaul.

When the motor is disassembled for any reason, [illegible]ricate as follows:

1. Oil wicks should be resaturated.
2. The armature shaft and bushings should be coated with Delco-Remy Lubricant No. 1960954.
3. The roll type overrunning clutch requires no lubrication. However, the drive assembly should be wiped clean.

CAUTION: Do not clean in any degreasing tank or with grease dissolving solvents; this will dissolve the lubricant in the clutch mechanism.

4. Avoid excessive lubrication.

C. IN VEHICLE TEST

Several checks, both visual and electrical, should be made in a defective cranking circuit to isolate trouble before removing any unit. Before removing a unit in a defective cranking system, the following checks should be made.

1. Determine the condition of the battery, follow the testing procedure outlined in BATTERY Section.
2. Inspect the wiring for frayed insulation or other damage. Replace any wiring, that is damaged. Inspect all connections to the starter motor solenoid, ignition switch and battery, including all ground connections. Clean and tighten all connections and wiring as required.
3. Inspect solenoid and ignition switch to determine their condition. Connect a jumper lead around any switch suspected of being defective. If the system functions properly using this method, repair or replace the bypassed switch.
4. Check engine for tight bearings, pistons, heavy oil, etc., which imposes extra heavy loads on starter motor.

D. STARTER MOTOR REMOVAL

Due to starter motor being completely enclosed, it must be removed from the engine any time it requires service.

1. Lift operator's seat and swing open right hand side panel.
2. Disconnect all electrical leads from starter motor or starter motor solenoid.
3. Remove mounting bolts which attach starter motor to flywheel housing.

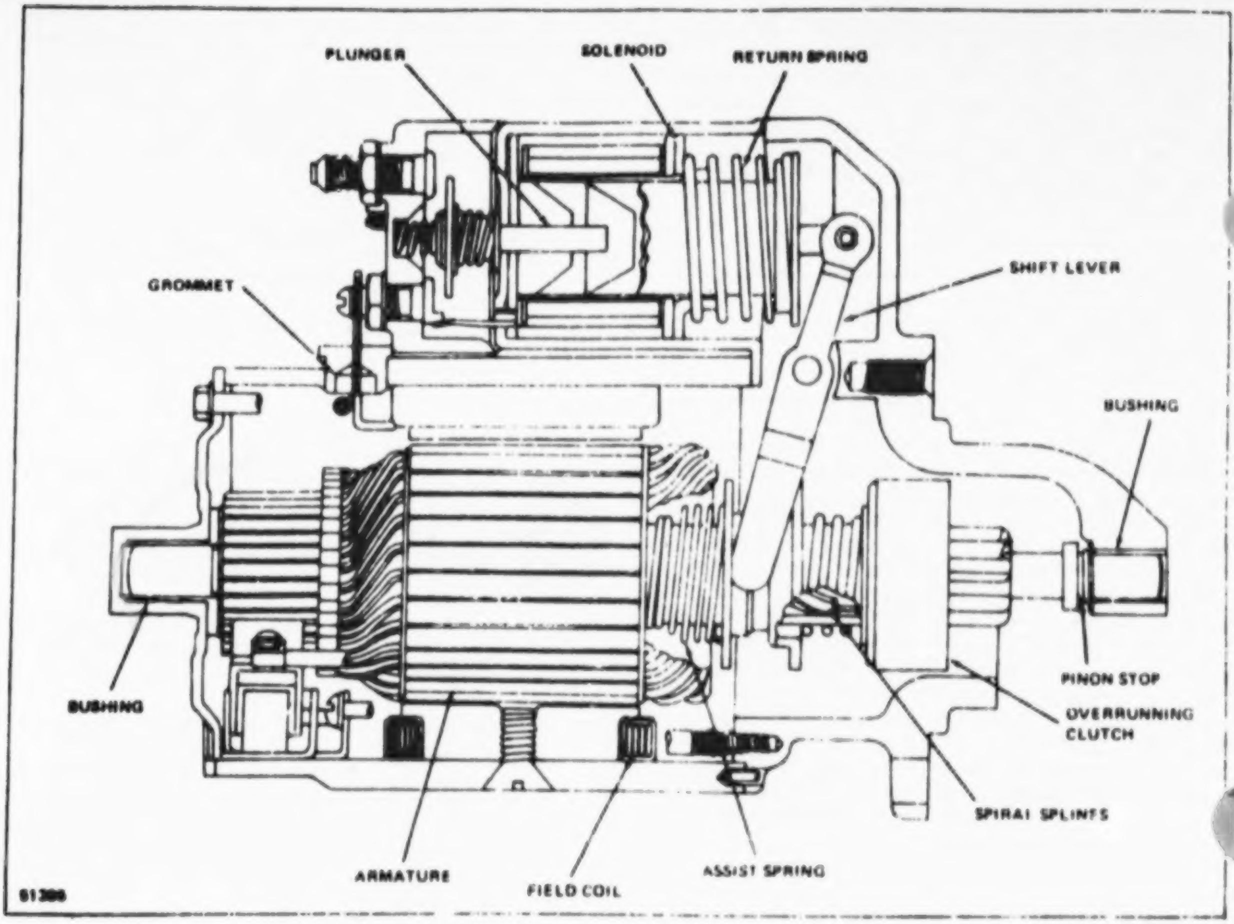

PLUNGER
SOLENOID
RETURN SPRING
GROMMET
SHIFT LEVER
BUSHING
BUSHING
PINON STOP
OVERRUNNING CLUTCH
SPIRAL SPLINES
ARMATURE
FIELD COIL
ASSIST SPRING
61300

Figure 3-1. Starter Motor (Sectional View)

STARTER MOTOR TEST SPECIFICATIONS

Rotation Viewing D.E.	Min. Brush Spring Tension (oz.)	No Load Test					Resistance Test		
		Volts	Min. Amps.	Max. Amps.	Min. RPM	Max. RPM	Volts	Min. Amps.	Max. Amps.
C	35	9	50*	80*	5500	10500	4.3	270*	310*

*Includes Solenoid

4. Pull starter out of flywheel housing until drive end clears flywheel housing and tilt commutator end up to remove unit from truck.

E. STARTER MOTOR CHECKS

With the starter motor removed from the vehicle, the pinion should be checked for freedom of operation by turning it on the screw shaft. The armature should be checked for freedom of operation by turning the pinion. Tight, dirty, or worn bearings, bent armature shaft, or loose pole shoe screw will cause the armature to drag and it will not turn freely. If the armature does not turn freely, the motor should be disassembled for repair. If the armature does operate freely, the starter motor should be given a no-load test before disassembly.

1. No-Load Test

Connect the starter motor in series with a fully charged battery of specified voltage, an ammeter capable of reading several hundred amperes and a variable resistance. Also connect a voltmeter, as illustrated in Figure 3-2. An r.p.m. indicator is necessary to measure armature speed. Obtain the specified voltage by varying the resistance unit. Then read the current draw and the armature speed and compare these readings with the values listed in the starter motor specifications.

Results of Test

a. Rated current draw and no-load speed indicates normal condition of the cranking motor.

b. Low free speed and high current draw indicates:

(1) Too much friction - tight, dirty, or worn bearings, bent armature shaft or loose pole shoes allowing armature to drag.

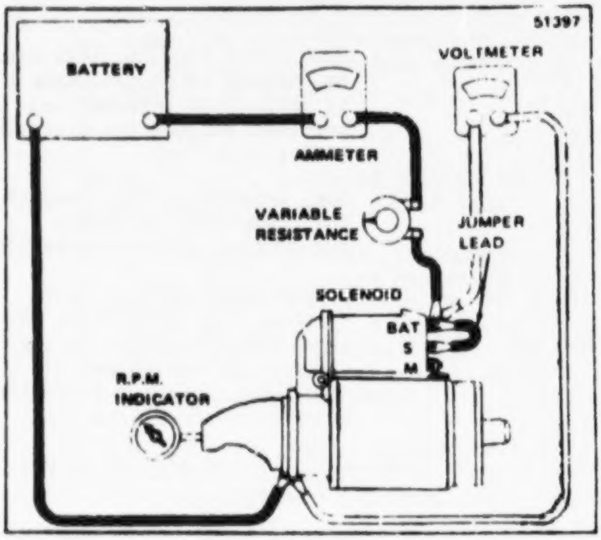


Figure 3-2. No-Load Test Hookup

(2) Shorted armature. This can be further checked on a growler after disassembly.

(3) Grounded armature or fields. Check further after disassembly.

c. Failure to operate with high current draw indicates:

(1) A direct ground in the terminal or fields.

(2) "Frozen" bearings (this should have been determined by turning the armature by hand).

d. Failure to operate with no current draw indicates:

   (1) Open field circuit. This can be checked after disassembly by inspecting internal connections and tracing circuit with a test lamp.

   (2) Open armature coils. Inspect the commutator for badly burned bars after disassembly.

   (3) Broken brush springs, worn brushes, high insulation between the commutator bars or other causes which would prevent good contact between the brushes and commutator.

e. Low no-load speed and low current draw indicates:

   (1) High internal resistance due to poor connections, defective leads, dirty commutator and causes listed in Step "d"

f. High free speed and high current draw indicate shorted fields. If shorted fields are suspected, replace the field coil assembly and check for improved performance.

2. Resistance Test

This test requires equipment as illustrated in Figure 3-3. Lock the pinion securely so it cannot rotate. When the specified voltage is applied, the current should fall in a range as indicated in Starter Motor Test Specification Chart. A high current indicates shorted or grounded conductors, and a low current indicates excessive resistance.

F. DISASSEMBLY

If the starter does not perform in accordance with the specifications, it may need to be disassembled for further testing of the components. Normally the starter motor should be disassembled only so far as is necessary to make repair or replacement of the defective parts. Following are recommended instructions for disassembly procedure.

1. Disconnect the field coil connections from the solenoid motor terminal.

2. Remove the thru-bolts.

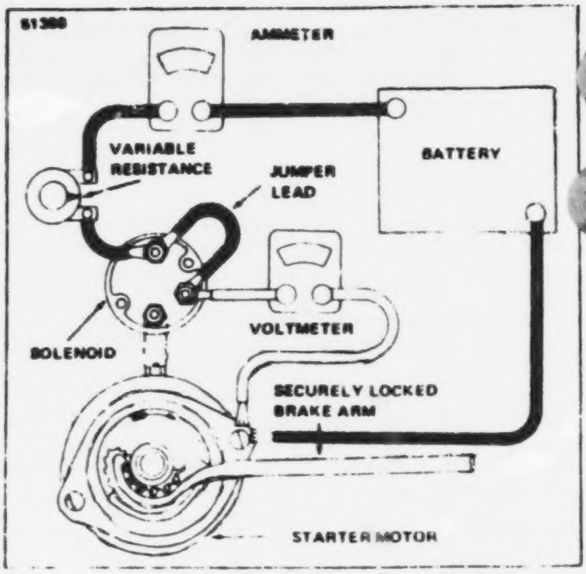


Figure 3-3. Resistance Test Hookup

3. Remove the commutator end frame and field frame assembly.

4. Remove the solenoid and shift lever assembly from the drive housing.

5. Remove the armature assembly from the drive housing.

6. Remove the thrust collar from the armature shaft.

7. Remove the pinion from the armature by sliding a metal cylinder onto the shaft. Using a hammer, strike the metal cylinder against the retainer, driving the retainer toward the armature core and off the snap ring. Refer to Figure 3-4.

8. Remove the snap ring from the groove in the armature shaft.

G. INSPECT AND REPAIR

1. Brushes and Brush Holders

   Inspect the brushes for wear. If they are worn down to one-half their original length, when compared with a new brush, they should be replaced. Make certain the brush holders are clean and the brushes are not binding in the holders. The full brush surface should ride on the commutator with a spring tension of 35 oz., to give good, firm contact. Brush leads and screws should be tight and clean.

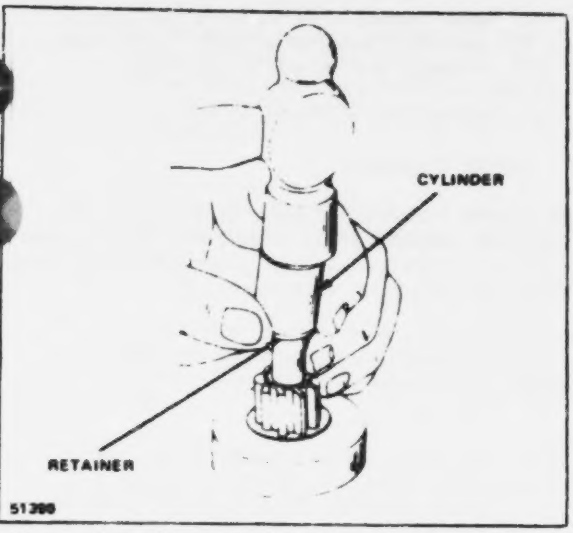


Figure 3-4. Removing Retainer from Snap Ring

2. Armature

The armature should be checked for short circuits, opens and grounds.

a. Check armature for shorts by placing it on a "growler", and with a steel strip or a hack saw blade held on armature core, rotate armature. If blade vibrates, armature is shorted in area of the core below the vibrating blade. Copper or brush dust in slots between commutator bars sometimes causes shorts which can be eliminated by cleaning out slots. Shorts or crossovers of coils at core end can often be eliminated by bending wire slightly and reinsulating exposed bare wire. If short cannot be eliminated armature must be replaced.

b. Opens may be located by inspecting the points where the conductors are joined to the commutator for loose connections. Poor connections cause arcing and burning of the commutator. If the bars are not badly burned, resolder the leads in the riser bars and turn the commutator down in a lathe. Then undercut the insulation between the commutator bars .031".

c. Grounds in the armature can be detected by the use of a test lamp. If the lamp lights when one test prod is placed on the commutator and the other test prod on the armature, the armature is grounded.

If the commutator is worn, dirty, out of round, or has high insulation, the commutator should be turned down and undercut as previously described.

3. Field Coils

The field coils should be checked for grounds and opens using a test lamp.

a. To check for grounds, disconnect the field coil ground connections. Connect one test prod to the field frame and the other to the field connector. If the lamp lights, the field coils are grounded and must be repaired or replaced.

b. To check for opens, connect test lamp prods to ends of field coils. If lamp does not light the field coils are open.

If the field coils need to be removed for repair or replacement, a pole shoe spreader and pole shoe screwdriver should be used. Care should be exercised in replacing the field coils to prevent grounding or shorting them as they are tightened into place. Where the pole shoe has a long lip on the side, it should be assembled in the direction of armature rotation.

H. REASSEMBLY

1. Place the clutch assembly on the armature shaft. To facilitate replacing the snap ring and retainer onto the armature.

a. Place the retainer on the armature shaft with the cupped surface facing the snap ring groove.

b. Place the snap ring on the end of the shaft. With a piece of wood on top of it, force the ring over the shaft with a light hammer blow (See Figure 3-5), then slide the ring down into the groove.

c. To force the retainer over the snap ring, place a suitable washer over the shaft and squeeze retainer and washer together with pliers (See Figure 3-6).

d. Remove the washer.

2. Refer to the disassembly procedure and follow in reverse to complete the reassembly.

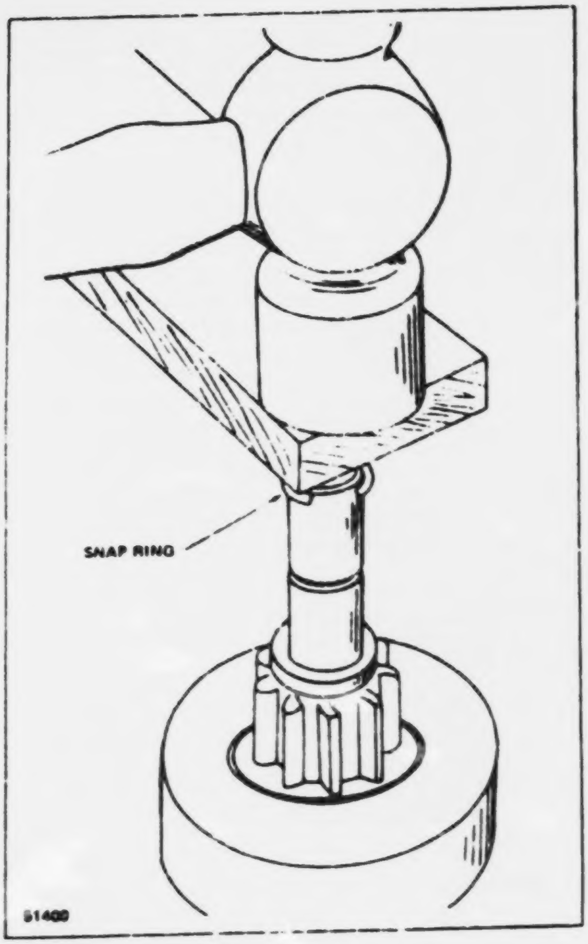

SNAP RING
51400

Figure 3-5. Forcing Snap Ring Over Shaft

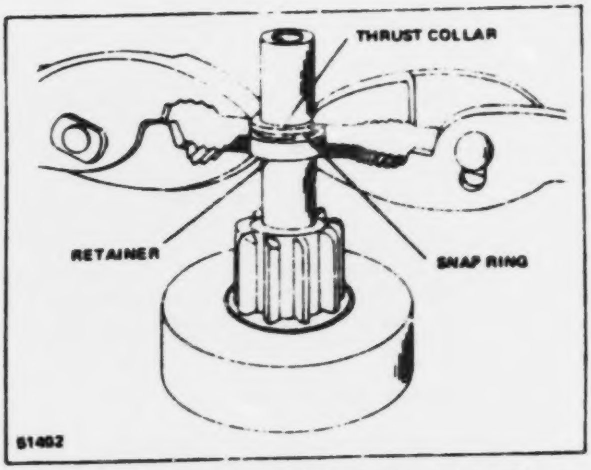

THRUST COLLAR
RETAINER
SNAP RING
51402

Figure 3-6. Forcing Retainer Over Snap Ring

3. When solenoid is reinstalled, apply sealing compound between field frame, flange, and solenoid junction.

I. PINION CLEARANCE

The pinion clearance cannot be adjusted but should be checked after reassembly of the motor to ensure proper clearance. Improper clearance is an indication of worn parts.

To check pinion clearance, the following procedure is recommended.

1. Disconnect the starter motor field coil connector from the solenoid motor terminal and insulate it carefully.

2. Connect a battery, of the same voltage as solenoid, from the solenoid switch terminal to the solenoid frame (See Figure 3-7).

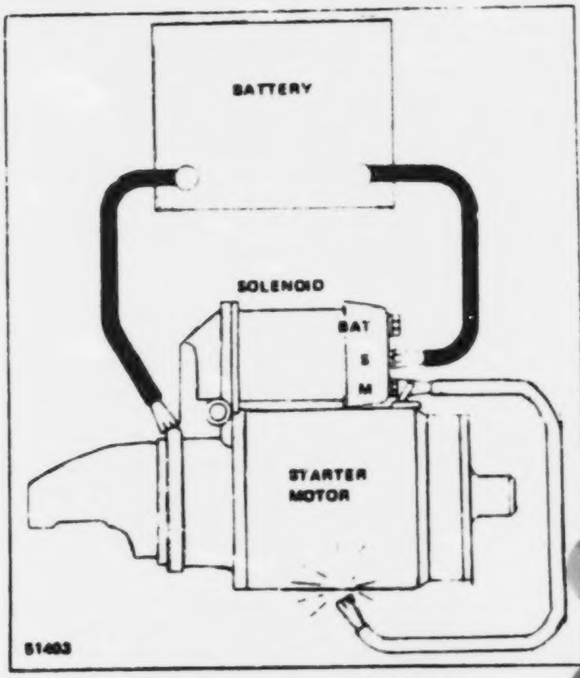

BATTERY
SOLENOID
BAT
S
M
STARTER MOTOR
51403

Figure 3-7. Circuit for Checking Pinion Clearance

3. Momentarily flash a jumper lead from the solenoid motor terminal to the solenoid frame. This will shift the pinion into cranking position and it will remain so until the battery is disconnected.

4. Push the pinion back toward the commutator end to eliminate slack movement.

5. Measure the distance between pinion and pinion stop (See Figure 3-8). Pinion clearance should be .010" to .140".

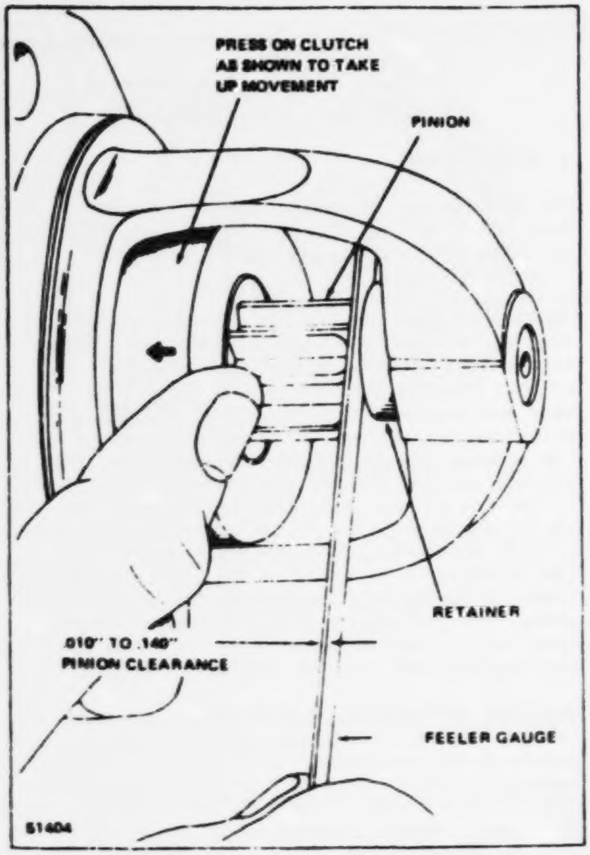

PRESS ON CLUTCH AS SHOWN TO TAKE UP MOVEMENT
PINION
RETAINER
.010" TO .140" PINION CLEARANCE
FEELER GAUGE
61404

Figure 3-8. Checking Pinion Clearance

J. STARTER MOTOR INSTALLATION

1. Insert drive end of starter motor in flywheel housing. If drive mechanism is fully extended, mesh pinion gear with flywheel ring gear. Install mounting bolts and tighten securely.

2. Connect all electrical leads to either starter motor or starter solenoid.

3. Close right hand side panel and lower operator's seat.

TOPIC 4. DISTRIBUTOR

GASOLINE AND L.P.G. ENGINES ONLY

A. DESCRIPTION

The distributor is mounted on the cylinder head and is driven from the engine lubricating oil pump extension at one-half the engine crankshaft speed.

The distributor consists of a cast housing into which a shaft and weight base are fitted in a bronze bushing. Centrifugal advance weights are pivoted on studs in the weight base and are free to move against the calibrated weight springs which connect them to the advance cam and breaker cam assembly. The advance cam and breaker cam assembly is fitted to the top of the shaft and rotates with the shaft, being actuated by the advance weights. Lateral movement of the weights advances the cam assembly in relation to the shaft as the speed is increased. The greater the engine speed, the farther out the distributor weights move, which increases the shift in the breaker cam position and in turn, advances the spark.

When the cam breaker is rotated by the centrifugal advance mechanism, each cam lobe passes under the breaker lever rubbing block, separating the contact points and producing a high voltage surge in the ignition circuit. With every breaker cam revolution, one spark will be produced for each engine cylinder. Since each cylinder fires every other revolution in a four stroke cycle engine, the distributor is required to rotate at only one-half the engine crankshaft speed to furnish ignition.

Built-in distributor lubrication is made possible with the use of a porous bushing, which extends from the upper to the lower part of the housing. A well is provided which is kept filled with oil. Seepage through the porous bushing provides shaft lubrication.

A dust cover located under the distributor cap completely seals off the breaker compartment from dust or dirt.

The high tension terminals on the ignition coil and the distributor cap are covered with tight fitting neoprene nipples to prevent moisture and dust accumulation, thereby preventing a conductive path to ground which would cause the engine to misfire.

NOTE: Refer to ENGINE MAINTENANCE MANUAL, ENGINE TUNE-UP, for specific distributor characteristics and distributor-to-engine timing procedure.

B. DISTRIBUTOR SERVICE

The distributor cap should be removed at regular intervals to examine the contact points, the rotor and cap. (Dust cover, located under cap, must be removed before contact points can be inspected.)

Check the high tension wiring for defective insulation and poor connections at the distributor cap and spark plugs. Wipe the distributor cap and check the cap and rotor for cracks or carbon tracks indicating leakage of high voltage current across the surface.

Check the centrifugal advance mechanism by turning the breaker cam in the direction of rotation and then releasing it. The advance springs should return the cam to its original position without sticking.

Inspect the contact points. If points are badly pitted or burned, they must be replaced as follows:

1. After distributor cap, rotor and dust seal have been removed from distributor housing, remove the nut and washer from the inner end of the primary terminal.
2. Remove the slotted head locking screw attaching the contact support to the distributor breaker plate, and remove the contact points. If condenser is to be replaced, remove screw attaching condenser to breaker plate and remove and discard condenser.
3. Install the replacement condenser. Apply a light coat of high quality silicone grease to the lobes of the breaker cam. Install the new contact support with breaker lever over the pivot post. Install the slotted head locking screw which attaches contact support to breaker plate but do not fully tighten screw as yet. Connect the primary lead to breaker plate.

NOTE: Make certain proper installation is made and all connections are tight.

4. Rotate crankshaft until the breaker lever rubbing block is on a high spot on the cam, thus opening the contact points to their maximum open position. Insert a screwdriver into the adjusting slot (Fig 4-1) and turn clockwise or counterclockwise until the specified

point gap of .020" is obtained. Lock points in this position by tightening contact point lock screw. After tightening lock screw, recheck point gap with .020" feeler gauge.

NOTE: Contact gap should be .020" ± .003".

5. Install dust cover, rotor and distributor cap.

C. REMOVAL

1. Remove the spark plug cables from the spark plugs, and label each one as it is disconnected. Remove the ignition coil cable from the ignition coil cap.
2. Disconnect the primary lead at the coil terminal.

NOTE: Distributor can be removed overhauled and replaced without retiming engine if distributor is returned to it's original position. Mark side of distributor, noting position of rotor before removing distributor from engine.

3. Remove nut and lockwasher from clamp stud and carefully lift distributor out of cylinder head.

D. DISASSEMBLY (See Figure 4-2)

1. Unlock distributor cap retaining clamps and remove distributor cap, rotor and dust seal.
2. Remove the contact points and condenser.
3. Remove screws and carefully remove breaker plate assembly from housing, taking care not to tear primary lead or protective rubber grommet. Remove retaining ring and remove breaker cam from shaft.
4. Using a sharp or pointed instrument, scribe a light mark on shaft coupling and shaft prior to removing coupling. This will assist in proper alignment during reassembly.
5. Remove coupling retainer spring pin, coupling, and seal from shaft. Shaft and weight support can now be removed from the distributor housing.

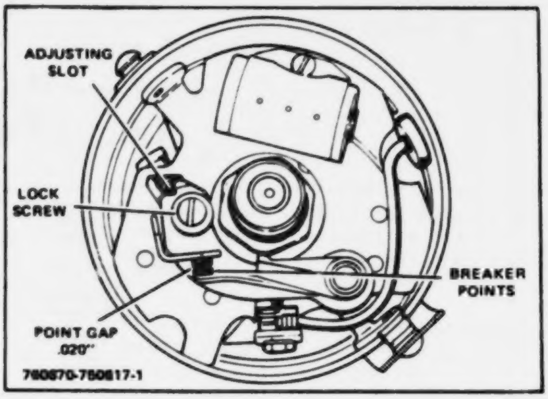


Figure 4-1. Adjusting Contact Gap

6. Remove screws, washers, and weight base and shaft from body.
7. Remove weight springs, weights and advance cam from shaft.

E. INSPECTION

Clean all parts thoroughly and replace any damaged or worn parts.

NOTE: Do not attempt to clean distributor cap, dust cover, rotor, condenser or housing in any degreasing compound, since this may cause damage to them.

1. Check centrifugal advance parts, weights, springs and plate for evidence of wear or damage.
2. Replace dust cover seal if hard, worn, or dirty.
3. Replace point contact set if worn, burned or badly pitted.
4. Check breaker leaver rubbing block for excessive wear.
5. If distributor housing bushing requires replacement, exercise care when replacing so as not to scratch or scuff the inside or outside of the bushing. Do not ream, scrape or file the bushing.
6. Check condenser for leakage. If it cannot be properly tested, then replace it with condenser of same value.
7. Check the distributor cap and rotor for cracks, burning of contacts or carbon

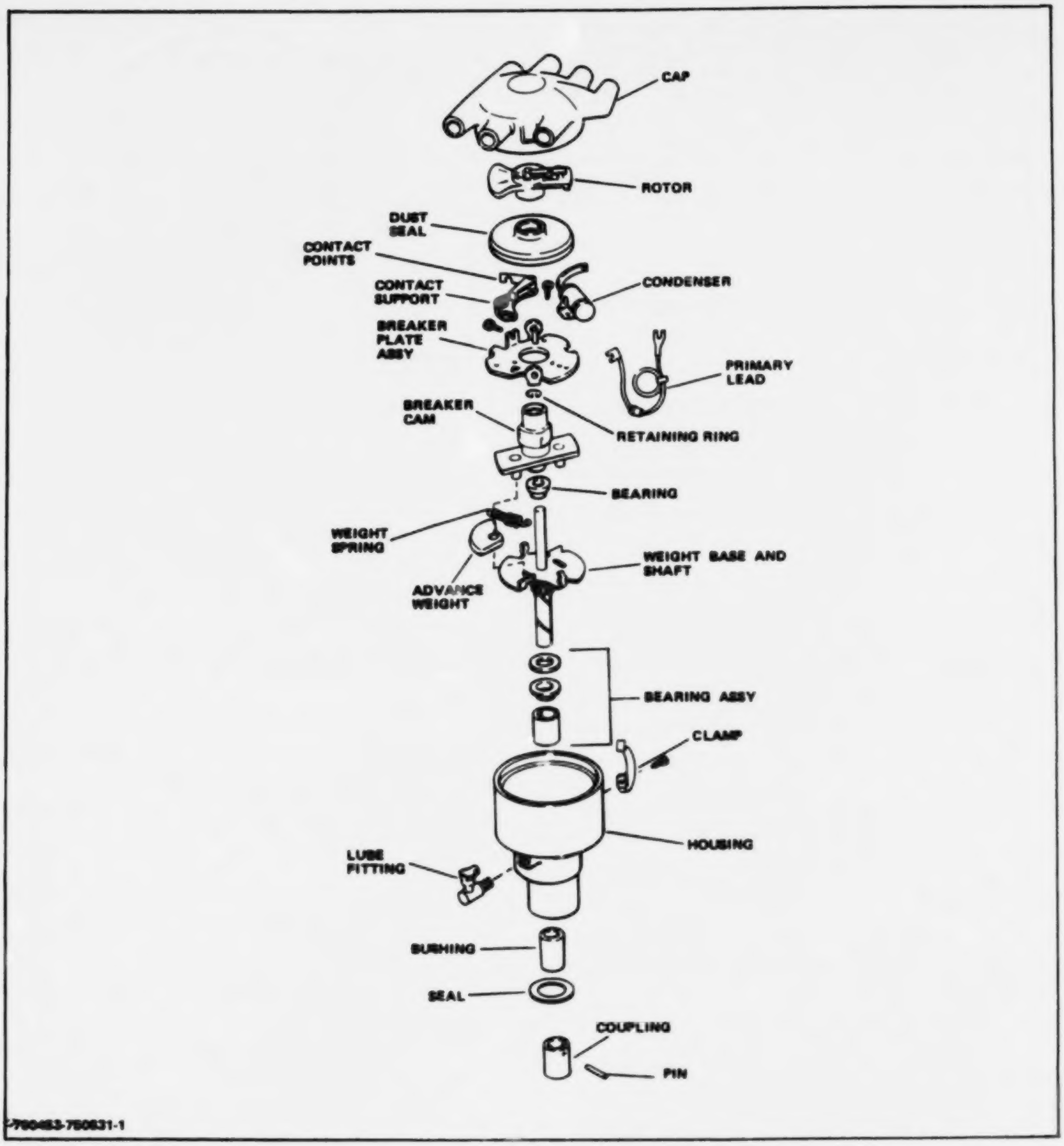

CAP
ROTOR
DUST SEAL
CONTACT POINTS
CONTACT SUPPORT
CONDENSER
BREAKER PLATE ASSY
PRIMARY LEAD
BREAKER CAM
RETAINING RING
BEARING
WEIGHT SPRING
WEIGHT BASE AND SHAFT
ADVANCE WEIGHT
BEARING ASSY
CLAMP
HOUSING
LUBE FITTING
BUSHING
SEAL
COUPLING
PIN
760453-760531-1

Figure 4-2. Distributor Assembly

streaks.

F. REASSEMBLY

During assembly of the distributor, make certain that all parts operate freely, as any binding may adversely affect the centrifugal advance.

1. Install advance weights on weight base. Place the cam assembly on the shaft and attach with retaining ring. Place a drop of oil on the weight pivot pin.
2. Coat drive shaft with light film of silicone grease. Place seal on shaft and install weight base, shaft and seal in distributor housing.
3. Install coupling on bottom of shaft,

making sure scribe marks on coupling and shaft are properly aligned. When holes for retainer pin are aligned, check end play of shaft.

NOTE: End play should be .003" to .010".

If end play is within these limits, install a new retainer pin and peen over ends. If end play is above or below specified limits, then shims may be added or removed until correct clearance is obtained.

4. Install breaker plate along with securing screws.
5. Install condenser and contact points. Using feeler gauge, set and lock contact points at .020" (See Section B, Service, Paragraph 4).
6. Install rotor.

G. INSTALLATION

1. Be sure rotor is positioned as it was before removal and install distributor. Using rotor, turn distributor shaft until tongue of coupling enters groove in top of distributor drive shaft.
2. Install holddown clamp, lockwasher and nut. Remove rotor and install dust cover, rotor and distributor cap.
3. Install spark plug wires as labeled and install high tension cable in distributor cap. Connect distributor primary lead to ignition coil.
4. Check engine timing. Refer to ENGINE MAINTENANCE MANUAL, TUNE-UP SECTION.

MEMO

TOPIC 1. COOLING SYSTEM DESCRIPTION

The function of the cooling system is to prevent the temperatures in the combustion chamber, which may reach as high as 4000°F., from damaging the engine and, at the same time, keep the operating temperatures within safe limits.

Maintaining the cooling system efficiency is important, as engine temperatures must be brought up to and maintained within satisfactory range for optimum operation; however the system must be kept from overheating, in order to prevent damage to valves, pistons and bearings.

See Figure 1-1. The system coolant is water which is force-circulated by a water pump. A thermostat and a by-pass hose, which form part of the system, serve to direct coolant flow through the engine only, or through the engine and the radiator.

Coolant from the water pump is first directed in the block against the exhaust valve seats and into passages connecting the cylinder head. This method provides the coldest water reaching the parts subjected to the highest temperatures.

The cylinder walls, in turn, are cooled their full length by convection currents only, which keep the cylinder barrels at a more uniform temperature and, thereby, reduce crankcase oil dilution and sludge formation. Upon leaving the cylinder head, the coolant enters the thermostat housing in which is mounted the by-pass type thermostat. Coolant passage to the radiator is controlled by the thermostat. Upon being discharged from the thermostat housing, the coolant enters the radiator, where it is cooled before re-entering the engine through the water pump.

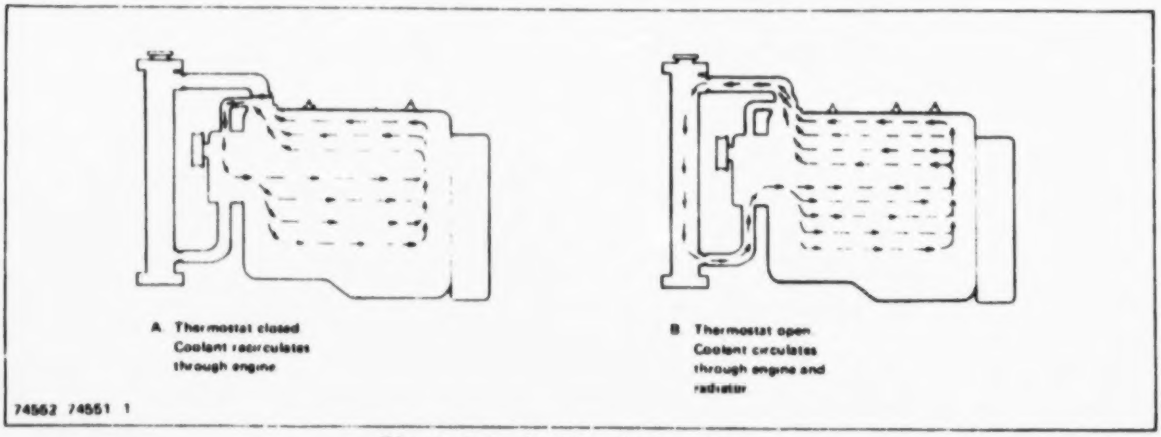
Teledyne Continental L-Head gasoline engines operate most efficiently with water temperatures of 180° to 200°F; the thermostat and by-pass hose are used to control these temperatures.

Before a cold engine reaches operating temperature, the thermostat valve is closed, passage to the by-pass hose is open, and the coolant recirculates through the engine block only. This provides for both rapid and even temperature increase of all engine parts during the warm-up period. When proper temperature is reached, the thermostat valve opens and allows the coolant to circulate through both the engine and the radiator.

Water has always been the most commonly used coolant for internal combustion engines because it has excellent heat transfer ability and is readily obtained everywhere. Like all liquids it expands when heated, the rate of expansion being 1/4 pint per gallon when the temperature is raised from 40° to 180°F.

For example: If a 4 gallon cooling system is filled completely full of water at 40°F, 1 pint will be lost through the radiator overflow pipe by the time the water temperature reaches 180°F.

Water boils at 212°F under atmospheric pressure at sea level. This pressure becomes less at higher altitudes and the reduced pressure causes water and other liquids to boil at a lower temperature. The chart shown in **Figure 1-2 shows the effect on boiling point** of water and anti-freeze solution.


A. Thermostat closed
Coolant recirculates
through engine

B. Thermostat open
Coolant circulates
through engine and
radiator

Figure 1-1. Cooling System, Cross Sectional View

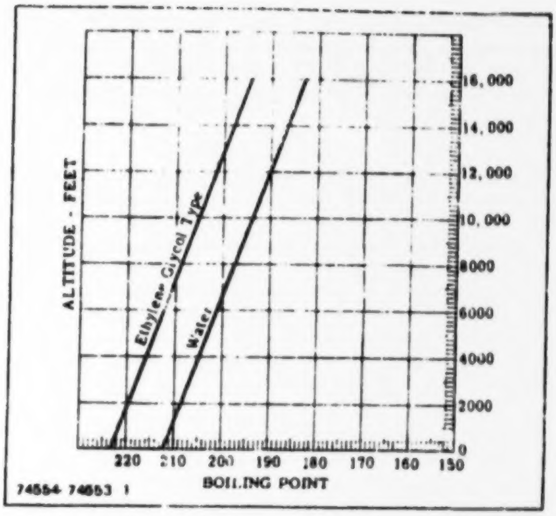


Figure 1-2. Effect of Altitude on Boiling Point of Coolant

CAUTION: Do not run engine without thermostat installed!

On Teledyne Continental engines, the thermostat performs an important function in achieving proper coolant flow through the radiator. The engine should never be operated without a thermostat installed, as serious damage can result.

Water freezes at 32°F., forms solid ice and expands about 9% in volume--which causes tremendous pressure and serious damage when allowed to freeze inside the cooling system.

When operating temperatures are below 32°F. an anti-freeze liquid must be added which will lower the freezing point a safe margin below the anticipated temperature of outside air.

The only approved anti-freeze is Ethylene Glycol, or permanent type, because of the temperature ranges it maintains for efficient operation of the engine. When no leaks are present, add water only to make up for evaporation, as follows:

Temperature Range	Parts Glycol	to	Parts Water
32° to 10°F	1		4
+10° to -10°F	2		5
-10° to -30°F	1		1

TOPIC 2. WATER PUMP

A. DESCRIPTION

Liquid coolant is circulated through the engine and the radiator by a centrifugal water pump. The pump is enclosed in a sealed, cast metal housing and is flange mounted to the engine block. The pump impeller is pressed on one end of a steel shaft and the fan drive pulley is pressed on the other end. The shaft is supported at the drive end by a sealed, double row ball bearing, and is prevented from moving endwise by a retainer ring and a shoulder in the pump housing.

Coolant is prevented from seeping along the shaft at the impeller end by a spring-loaded neoprene seal, which is retained in the pump housing by a bearing against the face of the impeller. Any coolant which does seep past the impeller is thrown from the shaft by a slinger before the coolant can enter the shaft bearing. The pump shaft and the bearing constitute one assembly and are serviced as such. The shaft bearing is the shielded type and is filled with lubricant when assembled, therefore no further lubrication is necessary

The construction of the water pump is conducive to long life with minimum attention if clean coolant is used in the system. Water containing scale forming elements is especially harmful to the pump parts due to corrosion.

B. SYSTEM REVERSE FLOW FLUSHING

When it becomes necessary to remove the water pump for service or replacement, the cooling system should be thoroughly cleaned first, by flushing the radiator and the water cooling jacket in the forward and reverse directions.

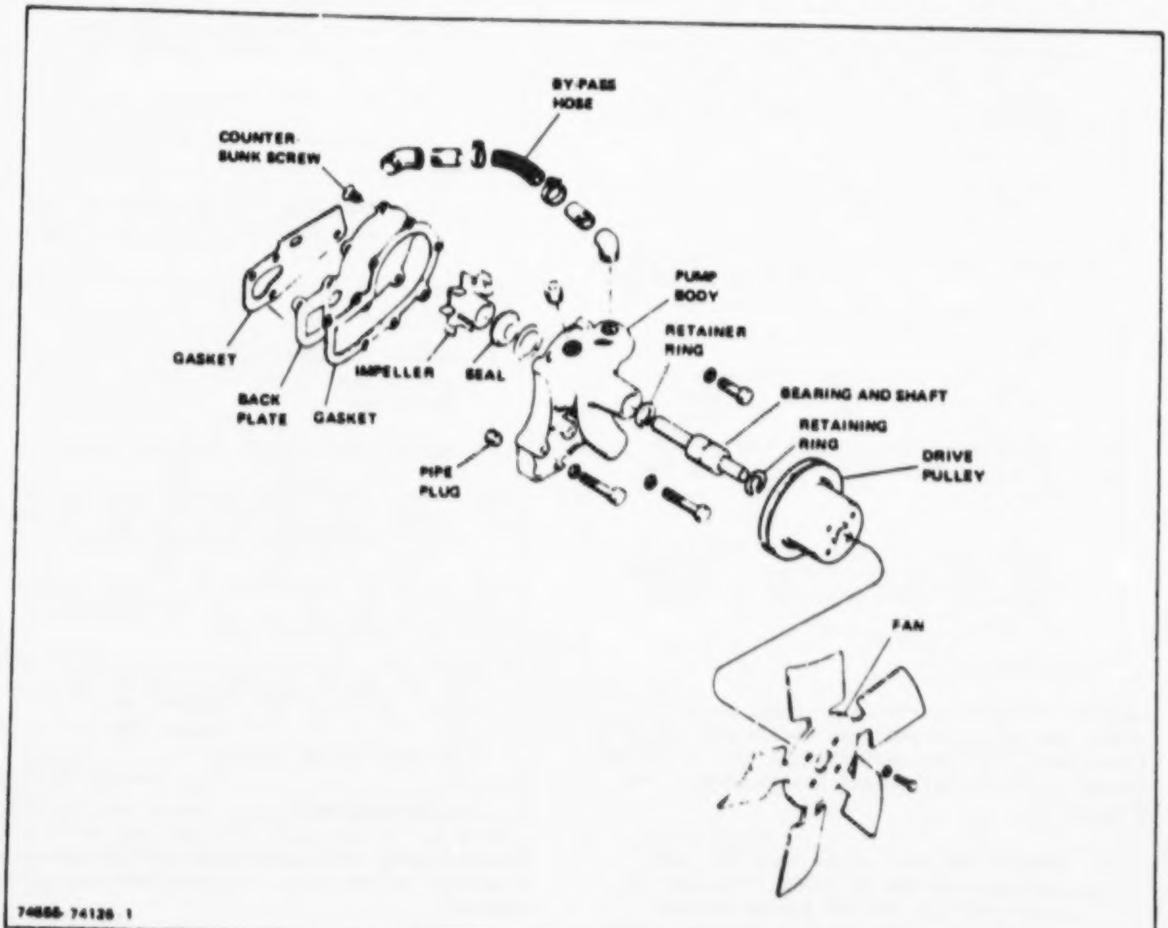


Figure 2-1. Water Pump, Exploded View

Purge the cooling system from all rust and scale by running the engine with a cleaning or flushing solution added to the coolant. The flushing solution is then drained through the radiator drain cock and the block drain cock located underneath the **alternator**. After draining, it is advisable to reverse flush the radiator first.

> **CAUTION: Allow engine to cool before reverse flushing the radiator. Refer to Topic 3 Radiator.**

C. WATER PUMP REMOVAL

Proceed as follows :

1. Remove the engine side panels and raise the operator's seat.
2. Loosen the alternator adjusting bracket capscrew and the alternator pivot mounting capscrew and push the alternator towards the engine until the fan belt tension is relieved. Remove the fan belt.
3. Remove the fan blade mounting capscrews and lockwashers then remove the fan.
4. Remove the radiator pressure cap, open the drain cocks located beneath radiator and the **alternator**, and drain the cooling system.
5. Loosen the hose clamp and remove the bottom hose leading from radiator.
6. Loosen the clamp at each end of the coolant by-pass hose, and remove the hose.
7. Remove the capscrews which secure the water pump to the cylinder block, then remove the water pump and the flange gasket.

D. DISASSEMBLY

When disassembling the water pump, an arbor press and suitable pressing blocks are required. Disassembly must be performed in the following sequence to prevent damage to the pump. See **Figure 2-1.**

1. Remove the back plate from the pump and measure the distance from rear of pump body to rear of pulley flange, **see Figure 2-2. This measurement, "A" shown in Figure 2-2, insert, is used during pump installation.**

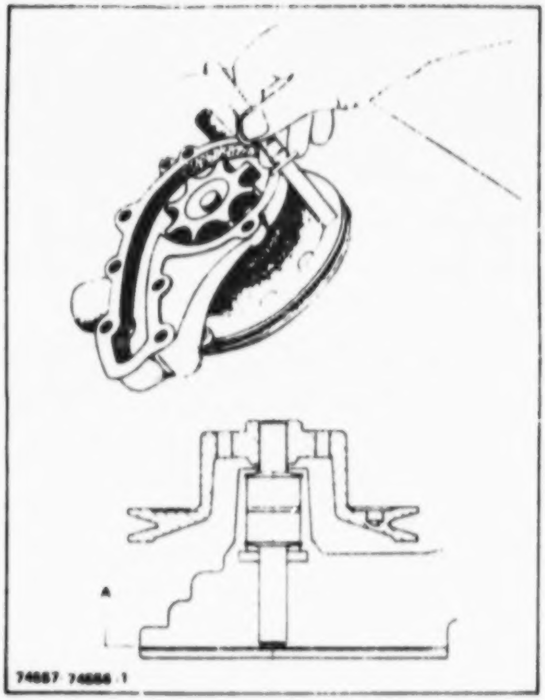


Figure 2-2. Measuring Distance Between Pump Body and Rear of Pulley Flange.

2. Use a puller to remove pulley from shaft, **see Figure 2-3.**
3. Remove the impeller using a puller. Take precautions to prevent damage to the pump body.
4. Remove the impeller seal and gasket.
5. Using long-nose pliers, remove the retainer ring that holds the bearing and shaft assembly in the pump body.
6. Using an arbor press or a lead hammer, force the bearing and shaft assembly out through the front.

> CAUTION: DO NOT attempt to drive the water pump shaft out through the rear. To do so, will damage the pump body beyond repair.

E. INSPECTION/REPAIR

Repair to the water pump will consist of replacement of any parts that are worn or damaged.

1. Clean rust or other deposits from pump parts and inspect for corrosion,

cracking, external damage or damage from pressing, or other defects which might impair efficient operation.

2. Check the bearing and shaft assembly by rotating the bearing. If movement is rough or the bearing is binding or running dry from lack of lubricant, the shaft and bearing assembly must be replaced.

CAUTION: Do not wash the bearing assembly as it is permanently lubricated at the factory.

3. Inspect the face of the impeller hub, where it contacts the seal, for any scoring or pitting. The face must be smooth so as not to damage the seal.

4. Check the impeller seal for a smooth, flat surface. A light film of lubricant applied to the face of the seal facilitates seating and sealing.

5. Always use a new pump gasket when reassembling.

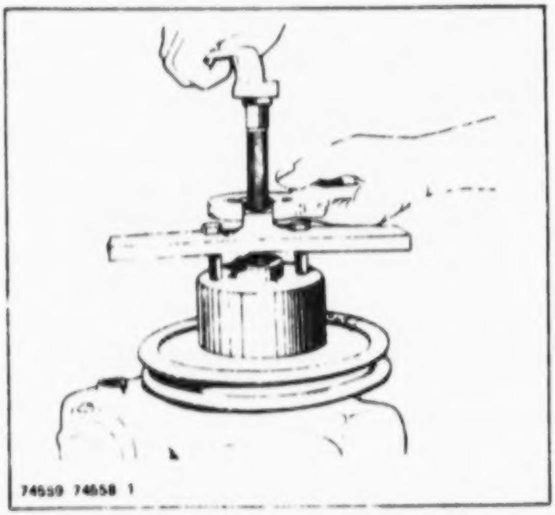


Figure 2-3. Removing Water Pump Pulley

F. ASSEMBLY

Reassemble the water pump by referring to Figure 2-1 for the relative location of the parts, and reversing the sequence of the disassembly procedure as follows:

1. When the bearing and shaft assembly is installed, use thick soap suds on the assembly and the impeller seal to prevent damage to the seal.

2. Install a new seal in the pump body. When installing the seal make certain it is square with the seal bore and is firmly seated.

3. Place the pump housing in an arbor press on a suitable support and press the shaft and bearing assembly into the bearing bore until the bearing is firmly seated against the inside housing shoulder.

NOTE: Care must be taken during this operation to prevent damage to the seal.

4. Install the retainer rings in the front and rear of the bearing.

5. Using an arbor press, install the impeller on the pump shaft until the impeller is flush with the end of the shaft. Revolve the impeller to make certain that it is free to turn and firmly seated on the seal.

NOTE: If the impeller is properly seated on the seal, a slight drag caused by the mating faces of the seal assembly and the impeller will be felt.

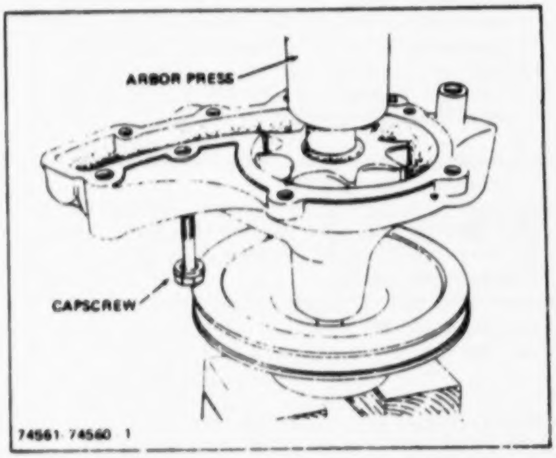


Figure 2-4. Water Pump Assembly Showing Inserted Capscrew, Prior to Pulley Press Fit.

G. INSTALLATION

1. Measure pulley and shaft. Recommended minimum press fit is .001". (Pulley must fit snugly on shaft)

2. Insert capscrew in pump body BEFORE pressing pulley on to shaft (Figure 2-4). Coat

inside of pulley bore with Loctite retainer compound.

3. Place the pulley on a flat surface, see Figure 2-5, pressing on END of shaft with arbor to dimension determined in the Disassembly section (Figure 2-2). Pulley should rotate freely.

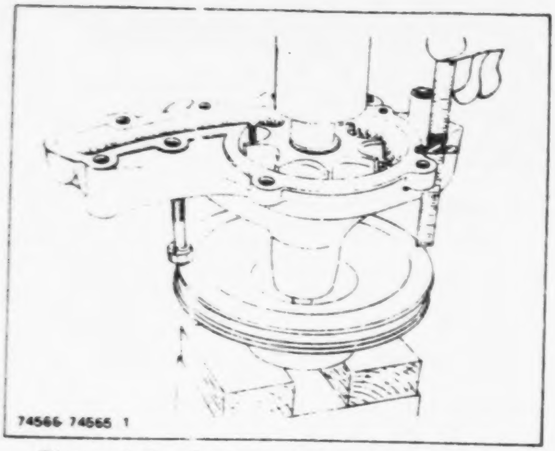


Figure 2-5. Pressing Water Pump Pulley to Correct Depth

4. Clean the gasket mounting surfaces on the water pump flange and on the cylinder block, and install new gasket. Use approved sealing compound as required.

5. Install and secure the water pump with mounting capscrews.

6. Replace the coolant by-pass hose and tighten the clamps.

CAUTION: Do not overtighten end nuts as this could cause by-pass tube to fracture or split.

7. Replace the lower hose connecting the radiator to the pump. Secure clamps.

8. Replace the by-pass hose connecting the pump to the thermostat housing on the cylinder head.

9. Close the drain cock at the bottom of the radiator and beneath the alternator.

NOTE: Ensure that the fan belt has been placed on the fan pulley prior to installing and securing the fan blade.

10. Install the fan blade with the mounting capscrews and lockwashers. Tighten capscrews securely.

11. Properly align fan belt at fan drive pulley, fan pulley and alternator pulley and adjust fan belt tension. After proper adjustment, secure alternator capscrews.

12. Fill the cooling system with clean water, including anti-freeze, if climate dictates. Replace radiator pressure cap.

CAUTION: DO NOT run the engine without water in the system. Running a pump dry will damage the seal and shorten pump life.

13. Operate the engine until the normal operating temperature has been reached, then check the cooling system for any evidence of leaks. Correct if necessary. After thermostat opens, coolant level should be topped-up.

14. Replace the engine side panels and lower the operator's seat.

TOPIC 3. RADIATOR

A. DESCRIPTION

The radiator is the fin and tube type and is vertically supported by angle bracing to the truck frame. The front of the radiator is protected from structural damage by a heavy grille mounted in the counterweight. An overflow tube is connected to the filler neck and leads to the bottom of the radiator.

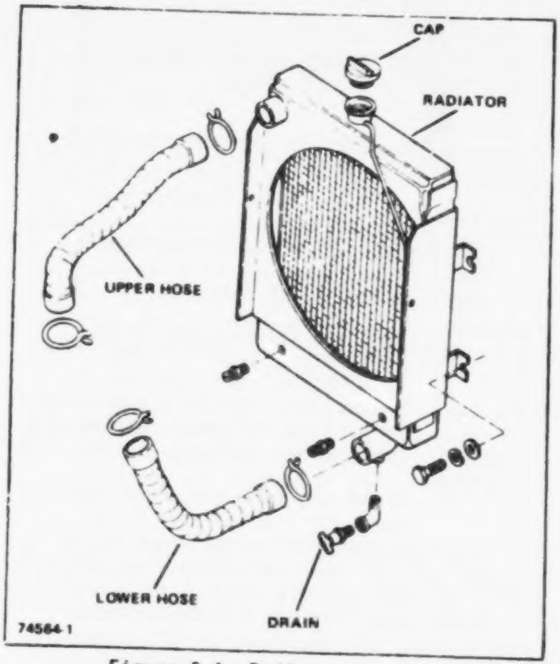


Figure 3-1. Radiator Assembly

B. REMOVAL

When it becomes necessary to remove the radiator for service, the following procedure is recommended:

1. Remove the engine side panels and raise the operator's seat.
2. Remove the radiator cap, open the drain cocks beneath radiator and alternator, and drain the cooling system.

CAUTION: Cooling system is pressurized. Coolant can boil if pressure is released at atmospheric pressure. When removing radiator cap protect hand with glove or rag. Rotate cap slowly until a hissing sound is heard. Leave cap in position until hissing stops, then turn cap until hissing starts again or cap comes free.

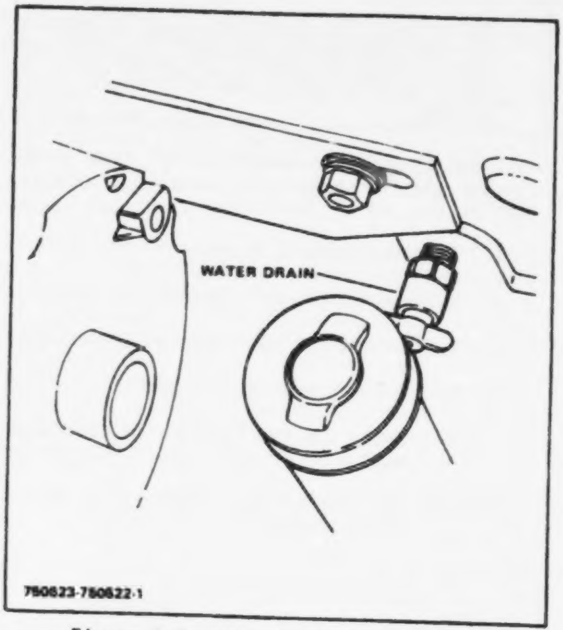


Figure 3-2. Water Drain Cock Location

3. Loosen the retaining hose clamps and remove the inlet and outlet hoses from the top and bottom of the radiator.

NOTE: An oil cooler is an integral part of the bottom of the radiator to prevent overheating of the transmission. The oil cooler lines must be removed prior to removing the radiator.

4. Remove the securing capscrews and the radiator grille from the back of the counterweight.
5. Remove the capscrews which hold the radiator in position on the mounting bars located on the frame inside the counterweight.
6. Slide the bottom of the radiator out of position. After the filler neck of the radiator has cleared the inside top of the counterweight, the radiator can easily be removed.

C. INSPECTION-SERVICE

If the tubes in the radiator become clogged, the obstructions may sometimes be removed by reverse flushing the radiator.

NOTE: It is not necessary to remove the radiator to perform reverse flushing. Simply disconnect the upper and lower radiator hoses and proceed as follows.

When the clogging is caused by debris or other similar foreign material it usually is deposited at the top of the tubes.

1. Radiator Reverse Flush

   Proceed as follows (see Figure 3-3):

   a. Disconnect the hoses at the engine.

   b. Put radiator cap on tight.

   c. Clamp the flushing gun in the lower hose with a hose clamp.

   d. Turn on the water and let it fill the radiator.

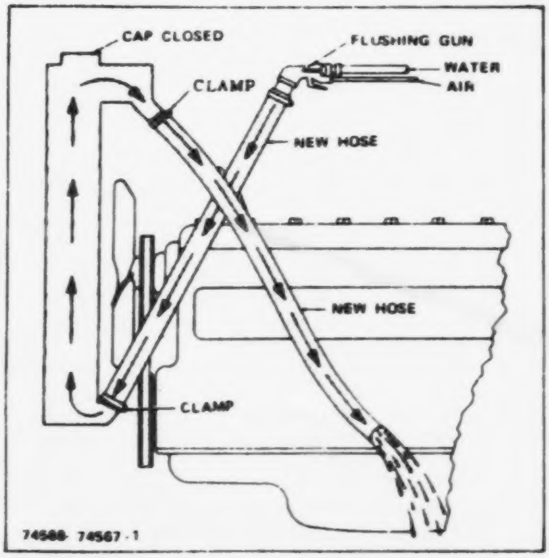


Figure 3-3. Reverse Flushing Radiator

   e. Apply air pressure (6 lbs. max) gradually, to avoid radiator damage.

   f. Shut off the air, again fill the radiator with water and apply air pressure--repeat until the flushing stream runs out clear.

   g. Clean and inspect radiator cap.

2. Engine Water Jacket Reverse Flush

   Proceed as follows (see Figure 3-4):

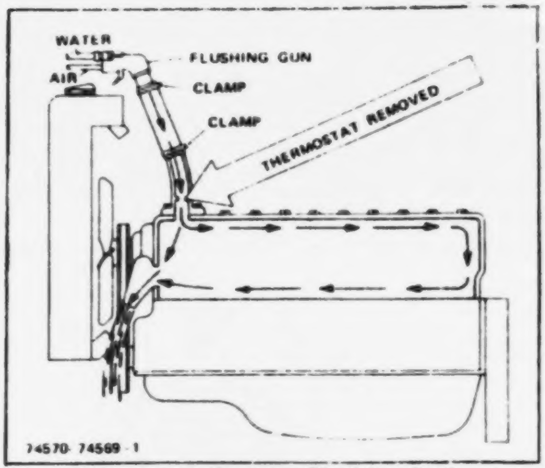


Figure 3-4. Reverse Flushing Engine

   a. Remove the thermostat.

   b. Clamp the flushing gun in the upper hose.

   c. Partly close the water pump opening to fill the engine jacket with water before applying air pressure.

   d. Follow the same procedure outlined above for the radiator by alternately filling the water jacket with water and blowing it out with air pressure (6 lbs. max.) until the flushing stream is clear.

To clean the cooling fins, it is best to direct an air blast carrying a grease solvent, such as oleum spirits or carbon tetrachloride, directed at the back side of the core and passing through to the front or engine side.

CAUTION: Never use gasoline, fuel oil or kerosene to clean the radiator.

WARNING: Always provide adequate ventilation of the working area during this operation to avoid possible toxic effects of the cleaning spray.

3. For regular periodic service of radiator cooling fins, simply direct a dry air blast against the rear of the radiator core to dislodge dust or lint which may have accumulated due to dusty operating conditions.

4. The "oil clutch" and "Power Shift" transmission oil cooler is an integral part of the lower tank of the radiator. To properly clean the oil cooler, flush tank with an acceptable highly volatile cleaning solvent and blow out with compressed air.

5. Oil cooler should be periodically checked for leaks or clogging.

6. If any fractures or breaks are discovered during radiator inspection, then the radiator should be brazed for proper sealing.

D. INSTALLATION

1. Slide the radiator up into mounting position within the counterweight, ensuring against any damage to filler neck or cooling fins.

2. With radiator properly aligned tighten two capscrews through radiator mount to frame support bars.

3. Install grille and secure grille and radiator with two capscrews. Secure grille with two remaining capscrews.

NOTE: The oil cooler lines will have to be replaced and tightened.

4. Replace the upper and lower radiator hoses and secure the retaining clamps. If hoses are cracked or cut, they must be replaced.

5. After radiator is installed, measure the distance between the leading edge of the fan blades and the radiator core. This dimension should be approximately 7/8". Also ensure that the cooling fan is properly centered within the radiator shroud.

6. **Close the cooling system drain cocks beneath radiator and in engine block and fill system to recommended capacity with coolant, replace the radiator pressure cap and check for leaks.**

NOTE: Allow engine to reach normal(160°F) operating temperature. The thermostat will then open and the coolant will flow into the engine. Coolant level must then be 'topped-up'.

7. Replace the engine side panels and lower the operator's seat.

E. CLEANING AND FLUSHING

It is recommended that the cooling system be cleaned at least twice a year, usually at the beginning of the cold weather season and before the anti-freeze solution is put into the system. Cleaning at these intervals will reduce the possibility of clogging or overheating, and will minimize the necessity of removing the radiator for special cleaning. If hard water has been used, the necessity for cleaning is even greater, since lime deposits or scale will form in the radiator, cylinder head and block. This lime deposit is detrimental to the engine and the radiator core.

Flushing the radiator will remove obstructions in the radiator tubes and other water passages, which, if not removed, would eventually clog these passages. It is also important that the air passages between the radiator tubes be kept free of obstructions and that the exterior of the engine be kept free from thick deposits of dust and oil. The following procedure is recommended to properly clean and flush the cooling system:

1. Sal Soda is a very effective and safe solvent for removal of lime, scale and other foreign deposits in the cooling system. It should be used in the proportions indicated and according to the directions printed on the container in which it is purchased. Many good cleaning solvents for this purpose are on the market; they should always be used according to directions.

CAUTION: Never mix anti-freeze compounds or inhibitors with any cleaning, neutralizing or flushing compounds

2. After the solvent has been in the cooling system the prescribed length of time, the system should be completely drained, and after the engine has cooled sufficiently, thoroughly flush with clean water.

3. The use of certain cleaning compounds requires the use of a neutralizer solution which is usually packed and sold with the cleaning compound, and should be used as directed.

4. If radiator is badly clogged, then reverse flushing is required. (Refer to Paragraph C, INSPECTION/SERVICE, this Topic).

5. After the cooling system has been cleaned or flushed, and before new coolant is added to the system, a complete inspection should be made to detect and correct any leaks that may have been uncovered.

   a. Inspect all hoses and fittings for signs of deterioration. Replace as is necessary.

   b. Check the cylinder head capscrews, hose clamps, and fitting connections. Tighten or replace where necessary.

EXHAUST SYSTEM

TOPIC 1. EXHAUST SYSTEM

A. DESCRIPTION

The purpose of the exhaust system is to safely and quietly channel the exhaust gases from the engine to the rear of the truck where the gases are vented into the air. The following components make up the typical exhaust system: The exhaust pipe, muffler, tail pipe and the attaching capscrew and clamp hardware items. (Figure 1.)

After combustion has occurred within the engine, the exhaust gases are released from the combustion chamber via the exhaust valves. From here, the gases are channeled through the exhaust manifold to the attaching exhaust pipe. The exhaust pipe carries the gases to the muffler which is so constructed as to greatly reduce the engine combustion noises and to entrap any glowing particles that might be suspended in exhaust gas.

he exhaust gases leave the muffler and are vented t the rear end of the truck via the tail pipe.

It is very important that the exhaust system reains tight and in good repair not only to keep the operating noise at a low level, but because of the danger of randomly escaping gas.

B. INSPECTION

1. Inspect muffler and exhaust and tail pipes carefully for any holes, fractures or corrosion. Replace defective component immediately when found.
2. Inspect each component juncture for security and tightness of connection.
3. Ensure that all components of exhaust system are properly clamped to the truck frame.

C. REMOVAL

When it becomes necessary to replace any or all of the exhaust system components, the following procedure is recommended:

1. Remove left hand side engine panel and raise left side of truck to gain access to muffler location.

WARNING: Before proceeding further, be absolutely sure that engine has not been running for at least an hour or two. This will ensure that exhaust system has cooled adequately.

2. To remove exhaust pipe, loosen clamp securing it to muffler and remove capscrews mounting exhaust pipe to exhaust manifold.

3. To remove tail pipe, loosen clamp securing it to muffler, and remove clamp securing it to truck frame.

4. To remove muffler, disconnect exhaust and tail pipes and remove the capscrews and washers securing it to the truck frame.

5. After muffler has been removed from truck, remove the rubber grommets from the mounting bracket.

D. INSTALLATION

1. Install rubber grommets in muffler mounting bracket and install muffler.

2. Secure exhaust pipe to muffler with clamp, and using new gasket, secure to manifold with capscrews.

3. Secure tail pipe to muffler and truck frame with clamp.

4. Inspect all connections for exhaust leaks. Repair as is necessary.

5. Lower left side of truck and replace the left hand side engine panel.

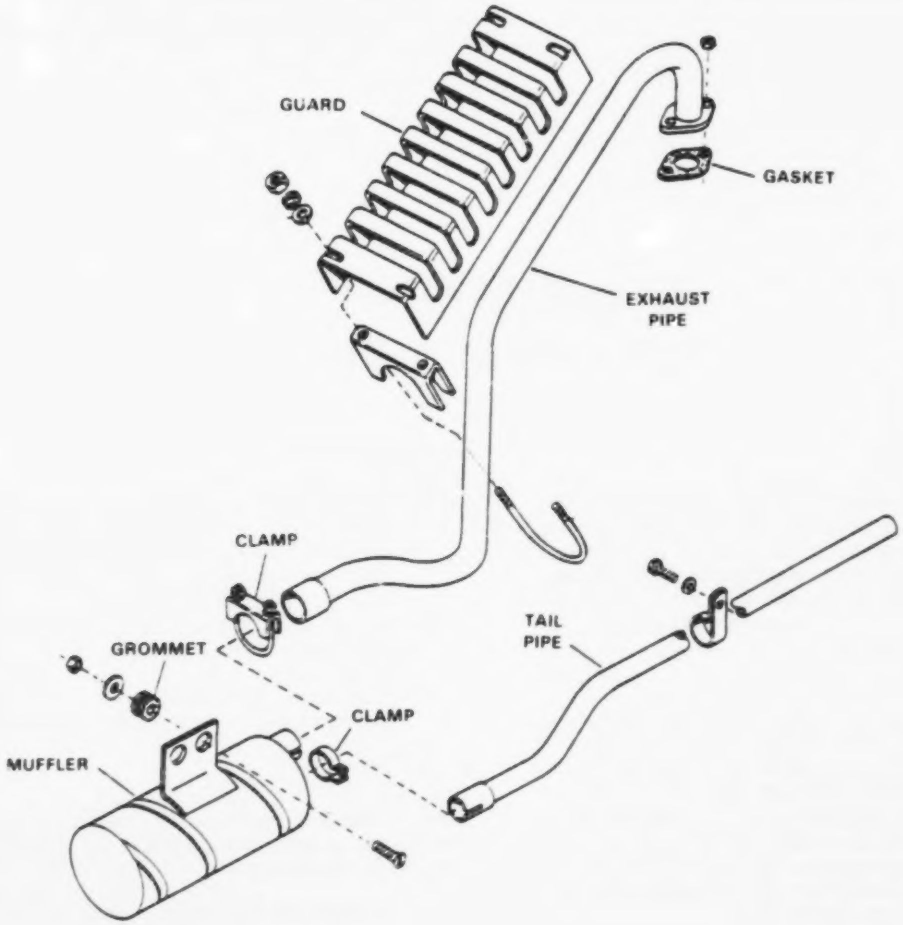


Figure 1. Exhaust System: Muffler, Exhaust and Tail Pipe (Typical)

TOPIC 1. TRANSMISSION

A. DESCRIPTION

The "Power-Shift" transmission consists of three major components: The torque converter, a hydraulically actuated clutch pack and a single speed, constant mesh transmission. A single lever type shift control is mounted on the steering column to control the direction of travel through a control valve mounted on the transmission housing.

Power from the engine is delivered to the torque converter which, in turn, drives a pump and clutch pack. Housed in the clutch drum are two double faced clutch plates which, when activated, move the truck forward or reverse through splined hubs, transmitting power to the gear train.

If the reverse clutch is activated, power is delivered to the transmission through a hollow shaft which connects the reverse gear and reverse clutch. If the forward clutch is actuated, power is delivered to the transmission through a solid shaft, which rotates inside the hollow reverse shaft, connecting the forward gear and forward clutch.

TORQUE CONVERTER

The torque converter is composed of three members: The impeller or driving member, the turbine or driven member, and the stator or reaction member. The impeller forms the outer shell of the converter, and the turbine and stator operate within the impeller but turn free of the impeller. The impeller is mounted on the engine flywheel and always turns at engine speed.

The torque converter is filled with oil and when the impeller is rotated by the engine, the oil in the impeller vanes also rotates; and, being subjected to centrifugal force, causes the oil to flow outward. At the beginning, the turbine is stationary, and there is no centrifugal force on the oil in it. Therefore, the oil in the impeller, due to its centrifugal force, enters the turbine near its outer circumference and forces oil from the turbine back into the impeller near its inner circumference. A circulation of oil is set up, which continues as long as there is a difference between the speeds of the impeller and the turbine.

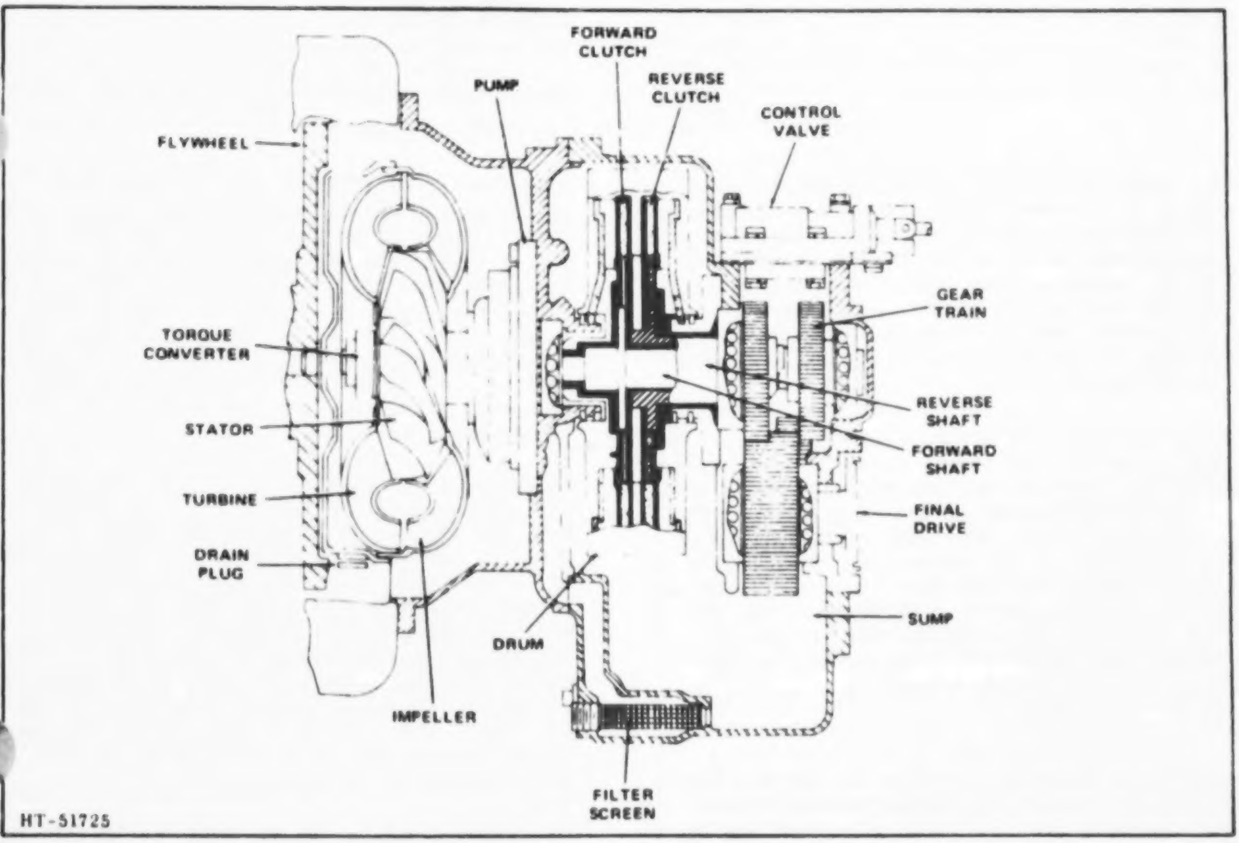


Figure 1-1. Power Shift Torque Converter Drive

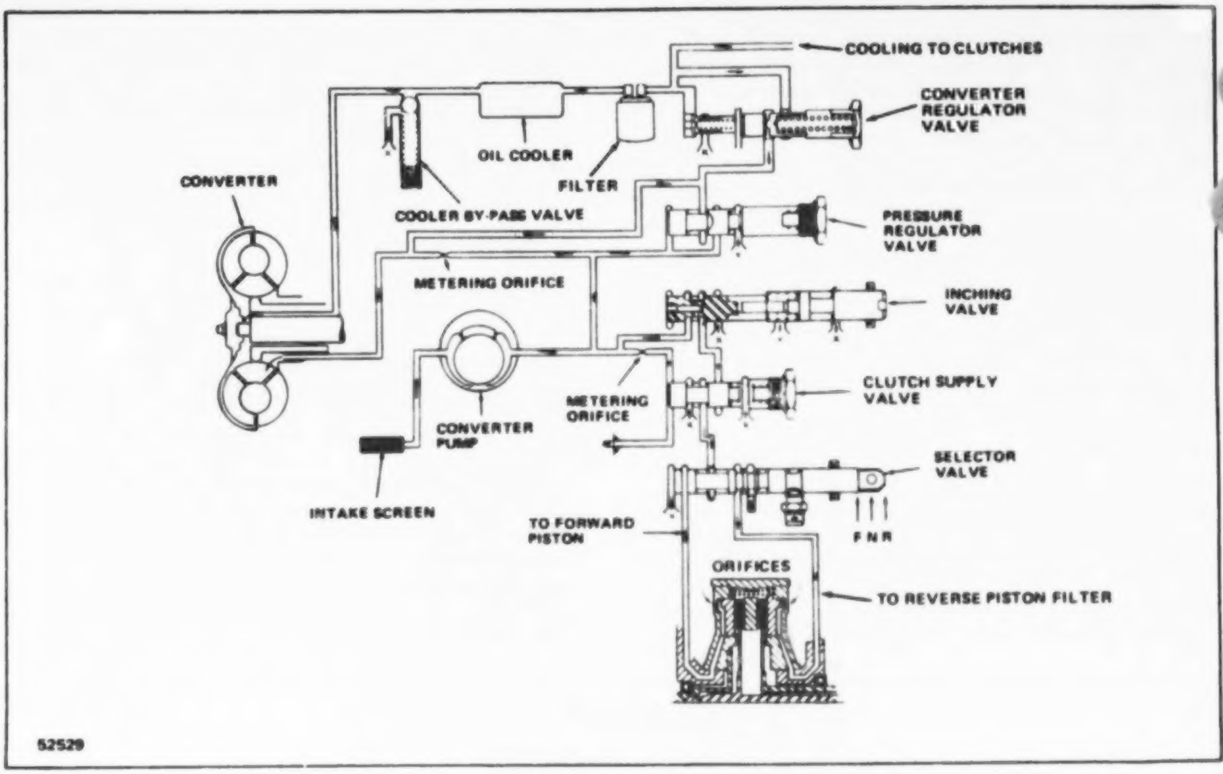

COOLING TO CLUTCHES
CONVERTER REGULATOR VALVE
OIL COOLER
FILTER
CONVERTER
COOLER BY-PASS VALVE
PRESSURE REGULATOR VALVE
METERING ORIFICE
INCHING VALVE
CLUTCH SUPPLY VALVE
METERING ORIFICE
CONVERTER PUMP
INTAKE SCREEN
SELECTOR VALVE
F N R
TO FORWARD PISTON
ORIFICES
TO REVERSE PISTON FILTER
52529

Figure 1-2. Power Shift - Hydraulic Schematic

In normal Lift Truck operation the turbine turns at a slower speed than the impeller an since both are the same dimension, the centrifugal force on the oil in the impeler is always greater than that of the oil in the turbine. It is this difference plus the pressurized oil from the pump which causes the oil to circulate in and through the converter.

From the above it can be seen that the oil in the converter has a dual motion. It travels with the impeller and the turbine around the outer circumference of the converter and it also flows around the inner circumference or central core of the converter. As a result of these motions the oil carries a certain amount of kinetic energy. The velocity of the oil in the converter increases as the oil passes through the impeller to the turbine and decreases as it passes through the turbine back to the impeller.

Since the velocity increases in the impeller, its kinetic energy increases and this gain in kinetic energy can come only from the impeller. That is to say, when increasing the velocity of oil in its vanes, the impeller encounters a resistance, and it takes power (from the engine) to keep the impeller running against this resistance. In the turbine the oil is slowed down and presses forward against the vanes, and when the turbine is moving under this force, power to drive the truck is produced. Thus, all the oil passing through the impeller picks up energy and gives it to the turbine. Up to this point operation is the same as a fluid coupling and there is no torque multiplication.

To transmit velocity to the oil at the inner circumference of the converter, a third member, the stator, is added to the fluid coupling, between the impeller and the turbine. It is here that the fluid coupling becomes a torque converter. With the impeller rotating and the turbine stalled, the oil is driven through the curved blades of the turbine. The curved blades redirect the oil in the opposite direction from which it was received. As the oil leaves the turbine blades, it strikes the stator blades causing a reaction which produces torque multiplication.

The stator directs the oil back to the impeller where any remaining kinetic energy combines with the kinetic energy of the impeller oil, producing additional torque multiplication. When the output torque becomes high enough, the turbine starts to turn and the truck will move. As the turbine speeds up and its speed approaches the impeller speed, there is no longer any reaction on the stator and it starts to turn with the turbine. At this point the unit becomes a fluid coupling since there is no longer any torque multiplication.

POWER SHIFT HYDRAULIC SYSTEM:

The transmission hydraulic system consists of the torque converter, a hydraulic pump, the control valve and the clutch pack.

Control Valve

The control valve is mounted on the transmision housing and forms the top closure of the gear case. Machined porting plates are attached to the bottom of the valve to eliminate external piping. Passages in the plates align with passages drilled or cast into the transmission housing.

Clutch Pack

The clutch pack consists of a drum, a forward and a reverse clutch, and pistons and cylinders. The clutches are engaged by oil pressure applied behind the clutch pistons, which causes engagement within the drum.

Oil Pump

The gear type oil pump provides hydraulic pressure for the converter and clutch pack. It is directly driven from the input side of the converter. Since the converter is mounted on the flywheel, the pump is in operation whenever the engine is running. This means that there is hydraulic pressure even with the engine idling.

Hydraulic oil enters the pump through the intake screen and case passages. Oil leaving the pump is directed through case and adapter passages to all open valve body passages and through an orifice to convertor. The orifice acts to drop pressure of the oil entering the converter. Oil leaving the converter is fed through cooler and cooler bypass valve. The bypass valve remains closed unless the pressure exceeds the valve opening limits. Oil returning from the cooler is directed to clutch cooling and lube circuit.

Pressure Regulator Valve

Oil from the pump, after filling all open circuits, begins increasing in pressure and continues to increase until the force from the oil on the end of the pressure regulator valve overcomes the spring force and moves the regulator valve to a position where main line oil is fed to converter circuits. Feeding mainline oil into the converter circuit lowers line pressure and permits the spring force to balance the force from the oil on the end of the regulator valve, thus regulating line pressure. Oil from the regulator valve is fed through an external tube to bypass converter feed orifice to provide greater oil flow through converter and cooler circuit.

Inching Valve

The inching valve, when the inching valve plunger is in, will regulate the clutch maximum pressure, determined by the spring or springs used in this location. Depressing the inching pedal permits the plunger to move away from the spring, decreasing spring's effect on the inching valve to lower clutch pressure. Clutch pressure can be varied from 0 to maximum pressure obtainable from the spring combination in the valve body assembly. Clutch pressure regulated by the inching valve is less than the pressure regulated by the regulator valve. Pressure recommendations for your particular model should be obtained from the equipment manfacturer.

Clutch Supply Valve

Line pressure on the end of clutch supply valve moves valve against spring force and permits oil to feed from the inching valve to manual valve. The high and low gear cam operated valve can exhaust oil from the end of the clutch supply valve faster than it can be replaced through the feed orifice. Therefore, the spring force returns the valve to the blocking position. In the blocking position, neither clutch can be fed and both clutches are exhausted at the clutch supply valve, thus causing a neutral condition to exist in the transmission.

NOTE: Latest Allis-Chalmers models have eliminated the seat dump valve in favor of a mechanical system which returns the selector valve to neutral. As a result of this the external control passage of the clutch supply valve is plugged and there is no way to bleed pressure from the pilot section of the valve. The valve will shift into operating position when the engine starts, and will stay in that position as long as the engine is running. The valve no longer provides a useful function and is retained as part of the control valve for purposes of standardization with the two speed transmission.

Selector Valve

Forward (F) position permits oil to flow to the forward clutch and exhaust reverse clutch. Neutral (N) position permits the selector valve to block oil at the valve and exhaust both clutches. Reverse (R) position permits oil to flow to reverse clutch and exhaust forward clutch.

Converter Regulator Valve

Oil fed to converter from pressure regulator valve is directed to end of converter regulator valve. Any time force from oil on the end of the valve exceeds spring force, the valve opens to feed oil to lube and clutch cooling circuit.

Clutch Orifice and Flyball

Clutch cylinders or pistons are provided with either bleed holes or bleed holes and ball dump valve. These are provided to exhaust oil from the clutch cylinder and assure clutch release. Centrifugal force could cause pressure build-up within the clutch cylinder if bleeds were not provided. The flyball bleed provides fast release and permits higher apply pressure.

B. SERVICE

At the truck lubrication period, open trap door in floor plate and check the oil level of the transmission sump by use of the dipstick. Engine must be running for this check. Add automatic transmission fluid, if necessary, to bring the oil level up to the FULL mark on the dipstick. When so noted (every 1000 hours of operation), the transmission sump should be drained and refilled with new oil.

CAUTION: DO NOT OVERFILL TRANSMISSION.

No specific time intervals are given, but the shift control adjustment should be checked on occasion.

The transmission operating pressures should be checked whenever the unit is not operating efficiently or after any internal parts have been replaced. Make certain the oil cooler lines are tight. Refer to CHECK OUT PROCEDURES (TOPIC 2, TRANSMISSION MAINTENANCE MANUAL).

Check and adjust the shifting mechanism if necessary. Refer to TOPIC 3, TRANSMISSION MAINTENANCE MANUAL.

To check and service transmission oil cooler, refer to TOPIC 4, TRANSMISSION MAINTENANCE MANUAL.

To service the oil filter, refer to TOPIC 5, TRANSMISSION MAINTENANCE MANUAL.

At periodic inspections, make sure all mounting capscrews are tight. Make certain no oil is leaking past the output shaft and that the universal joints are tightly connected.

C. REMOVAL

When it becomes necessary to remove the transmission and/or converter for repair, the following procedure is recommended.

1. Remove the floor and toe plates, seat deck assembly, front screen and air filter.
2. Drain oil from transmission by removing drain plug at rear of sump.
3. Disconnect the cooler lines at the bottom and at the right side of the sump. Cap lines and plug holes to avoid contaminating system.
4. Remove all control linkage. Disconnect wires from neutral start switch.
5. Disconnect the universal joints at the transmission.
6. Remove the capscrews and lockwashers which mount the converter to the flywheel through the flywheel inspection hole. Use a suitable tool to rotate the flywheel.

NOTE: The convertor flex plate mounts the engine timing mark decal. The relationship between the flex plate and flywheel should be marked prior to convertor removal.

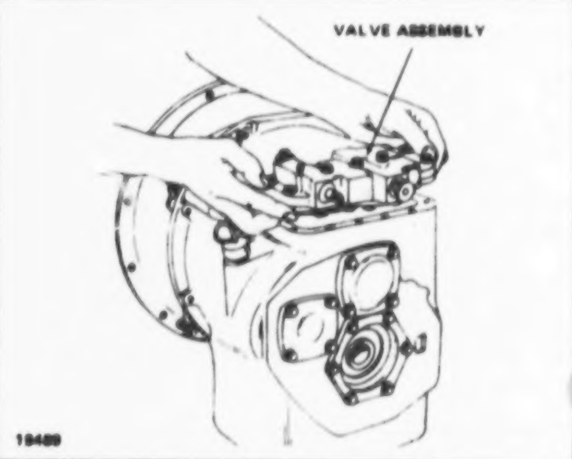


Figure 1-3. Removing Valve Block

7. Attach a lifting chain and hoist to transmission. Remove transmission mount-hardware and lift transmission from truck.

> CAUTION: Ensure that all attachments to transmission assembly that could hinder removal, have been disconnected and secured out of the way.

D. DISASSEMBLY

After transmission is removed from truck, place on a suitable work area, and proceed as follows for complete disassembly:

1. Carefully clean exterior of transmission to prevent contamination of system.
2. Disconnect tube from control valve and convertor housing.
3. Remove capscrews from valve block, and remove from transmission. Cover opening to avoid contamination. See Figure 1-3.
4. Slide converter off turbine shaft. Then mark the pump and the housing to ensure the proper reinstallation, and remove capscrews holding the pump and collector ring to converter housing. It may be necessary to tap the pump assembly with a rawhide hammer to free it from the gasket. (See Figure 1-4.)

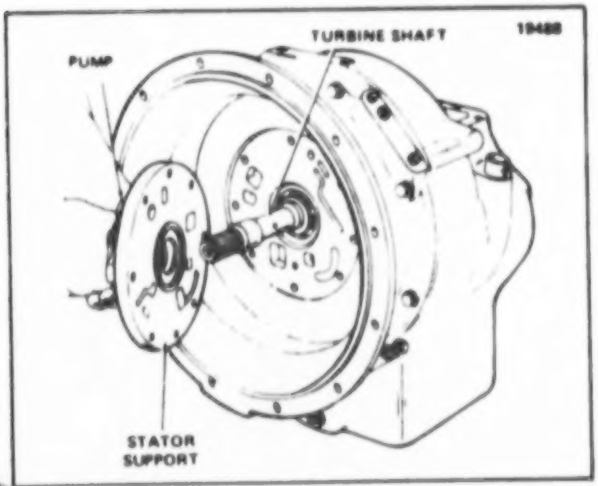


Figure 1-4. Pump Removal

5. Lay the transmission on the gear case side as shown in Figure 1-5. Remove capscrews which mount the converter housing to the gear case. Then, attach a chain to the housing and remove housing and drum assembly as a unit, taking care not to damage the seal rings in collector ring on gear case.

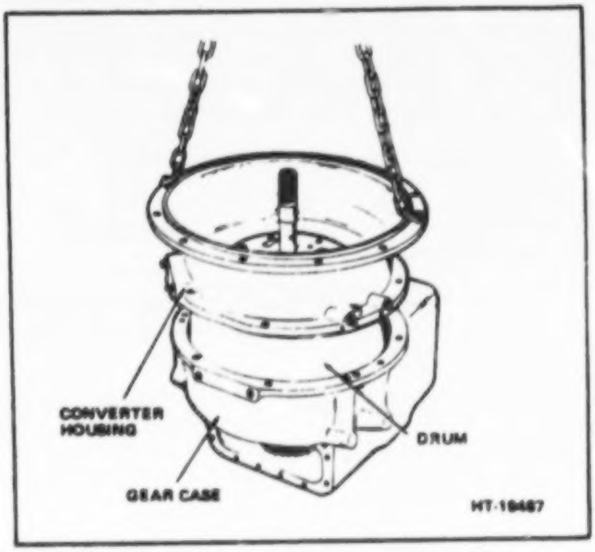


Figure 1-5. Removing Housing and Drum

6. To remove the converter housing from the drum, remove the snap ring on the turbine shaft and slide housing from drum assembly. Bearing will remain in housing. (Figure 1-6.)
7. Remove forward gear and shaft:
   a. Remove capscrews and lockwashers holding cap to housing and remove cap.
   b. Remove inner snap ring from the splined section of the forward

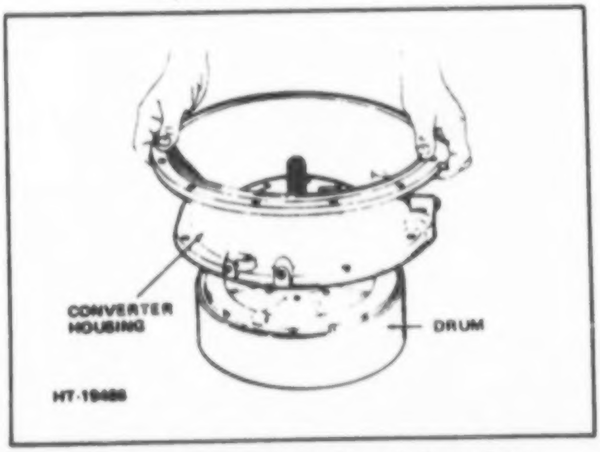


Figure 1-6. Removing Clutch Drum from Converter Housing.

shaft. Using a rawhide hammer, tap shaft at the clutch end and while holding forward gear, pull shaft from the gear box.

8. Remove reverse gear and shaft:

   a. Remove inner snap ring from the splined section of the reverse shaft.

   b. Mark relationship of bearing retainer and housing to ensure correct installation.

   c. Remove capscrews that secure the bearing retainer to the housing and remove the retainer. If seal rings have to be replaced, unhook at ring opening and remove.

   d. Remove the shaft while holding the reverse gear in the gear box.

   e. The bearings on both the forward and reverse drive shafts can be removed by removing the snap rings and pressing the bearings from the shafts.

NOTE: Mark gears and shafts so that they can be installed in their original relationships.

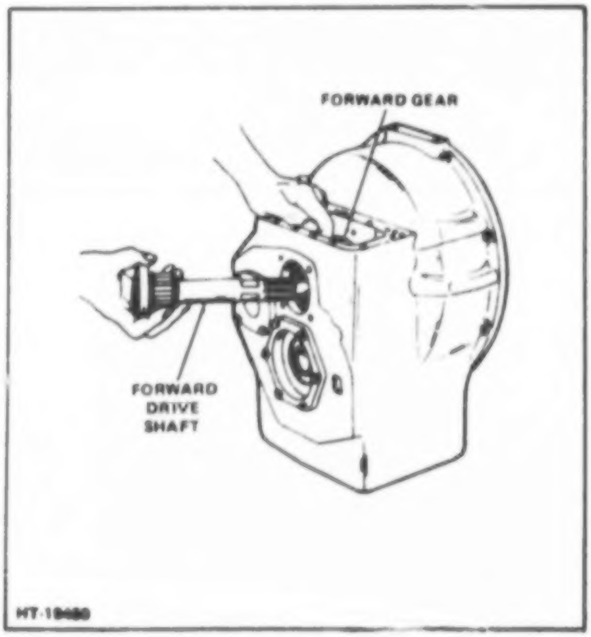

FORWARD GEAR
FORWARD DRIVE SHAFT
HT-19480

Figure 1-7. Removing Forward Gear and Shaft

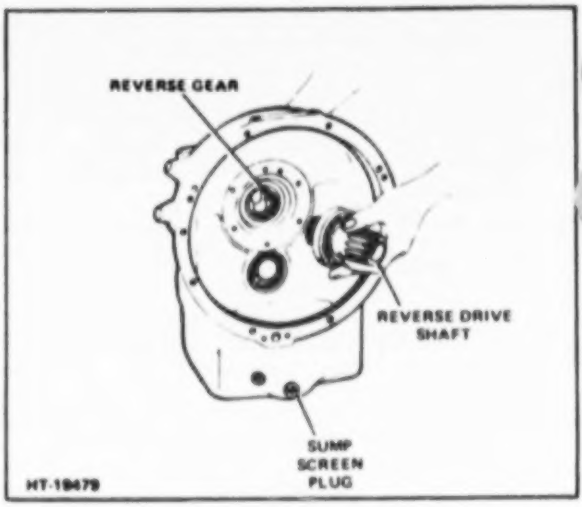

REVERSE GEAR
REVERSE DRIVE SHAFT
SUMP SCREEN PLUG
HT-19479

Figure 1-8. Removing Reverse Gear and Shaft

9. Remove idler gear and shaft:

   a. Remove capscrews holding idler gear shaft and cap to housing and remove cap and shaft. Note position of retaining pin holding shaft in cap to ensure proper reinstallation.

   b. Remove idler gear.

10. Remove output gear and shaft:

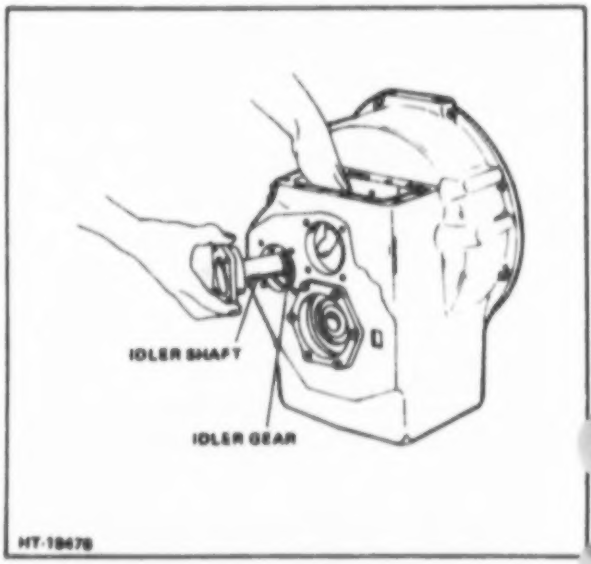

IDLER SHAFT
IDLER GEAR
HT-19478

Figure 1-9. Removing Idler Gear and Shaft

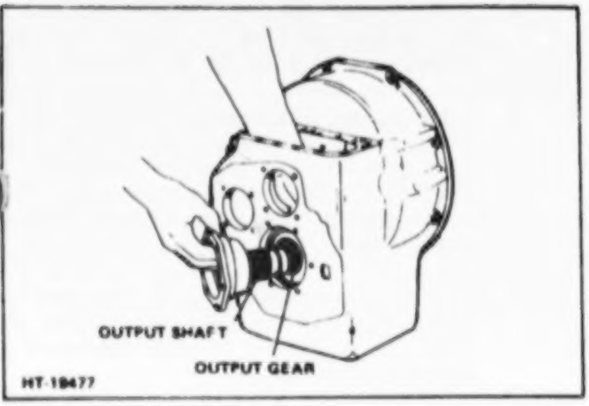


Figure 1-10. Removing Output Shaft and Gear

a. Remove capscrews holding output shaft cap to housing.

b. Remove output shaft and cap, while holding output gear inside gear box. It may be necessary to tap the output shaft from inside the clutch housing to facilitate removal.

c. Remove output gear.

11. Remove sump screen by removing sump screen plug (Fig. 1-8). Remove screen and spring through plug hole.

E. INSPECTION

Wash all parts, except oil seals, with suitable solvent. Blow out passages in housings with compressed air. Inspect bearings, seal rings, splined shafts, and gears for wear or damage. Inspect sump screen for clogged or damaged screen. Install new replacement gaskets.

> NOTE: Thoroughly clean the intake screen. In addition to soaking and washing, air streams should be directed from the inside toward the outside to remove material clogged in the screen.

F. REASSEMBLY

To reassemble the transmission, reverse the disassembly procedure and take note of the following precautionary measures:

1. Make certain spring is in place when installing the oil filter screen in housing.
2. Make sure output shaft is installed with the internal splines facing towards the outside of the gear case.
3. Make sure that the machined reliefs in the idler shaft cap are positioned down so that the oil in the cap will drain into housing.
4. As the gears and bearings are being installed, coat all surfaces with an acceptable lubricant and make sure they rotate freely in their respective locations.
5. When installing the bearing retainer, be certain to align the match marks made during disassembly. Make sure seal rings rotate on the bearing retainer and that rings are properly hooked together at ends.
6. When installing the forward and reverse drive shafts and gears, check to make sure that the snap rings holding the gears on the shafts are properly installed and seated.
7. Care should be exercised when installing the converter housing on the turbine shaft of the drum, so that misalignment does not occur during reassembly. Make sure that the snap ring holding the converter housing to the turbine shaft is properly seated.
8. When installing the converter housing and drum (as a unit) into transmission housing, care should be exercised so as not to damage the collector rings fitting into the drum. Damage to these rings will cause the reverse piston and drum to be inoperative.
9. Use new gasket when replacing control valve. Use new gaskets whenever old gaskets have been removed.
10. Connect tube assembly to valve and converter housing.

G. INSTALLATION

1. Attach lift chain and chain hoist to transmission assembly and maneuver transmission into position for installation.

CAUTION: Ensure that transmission mounting area is free and clear of any obstacles, such as linkage or hoses to prevent damage.

2. Position the converter in the pump at the back of the transmission, making sure that the converter hub tangs properly engage the pump.

3. Check timing decal on flex plate. Decal should be aligned with one of the outer bolt holes.

4. Be sure surface of flex plate is clean and dry and that decal is aligned with outside edge of flex plate.

5. With decal facing converter, install flex plate and reinforcing ring on converter and secure with place head bolts. Torque bolts to 43 to 49 lb. ft.

6. Install converter, with flex plate attached, on transmission input shaft. Check to be sure that both splines and tangs driving charging pump are fully engaged.

7. Turn converter to position timing decal on top.

8. Turn engine over until timing pointer on flywheel housing is visible through inspection hole in top of housing.

9. Lift transmission assembly into position on engine. Align timing decal with timing pointer in flywheel housing. Check marks made on flywheel and flex plate during removal to be sure they are aligned.

10. Pilot on converter must be inserted in mating hole in flywheel. Bolt heads on flex plate will match with clearance holes in flywheel.

11. Secure transmission housing to flywheel housing with two bolts.

12. With inspection hole cover on flywheel removed, install one place head bolt and special washer at the decal and torque to 20-23 lb. ft. Install and torque the remaining five bolts by turning flywheel to proper position for each one. Install inspection hole cover.

13. Install remaining transmission housing bolts. Connect universal point to transmission.

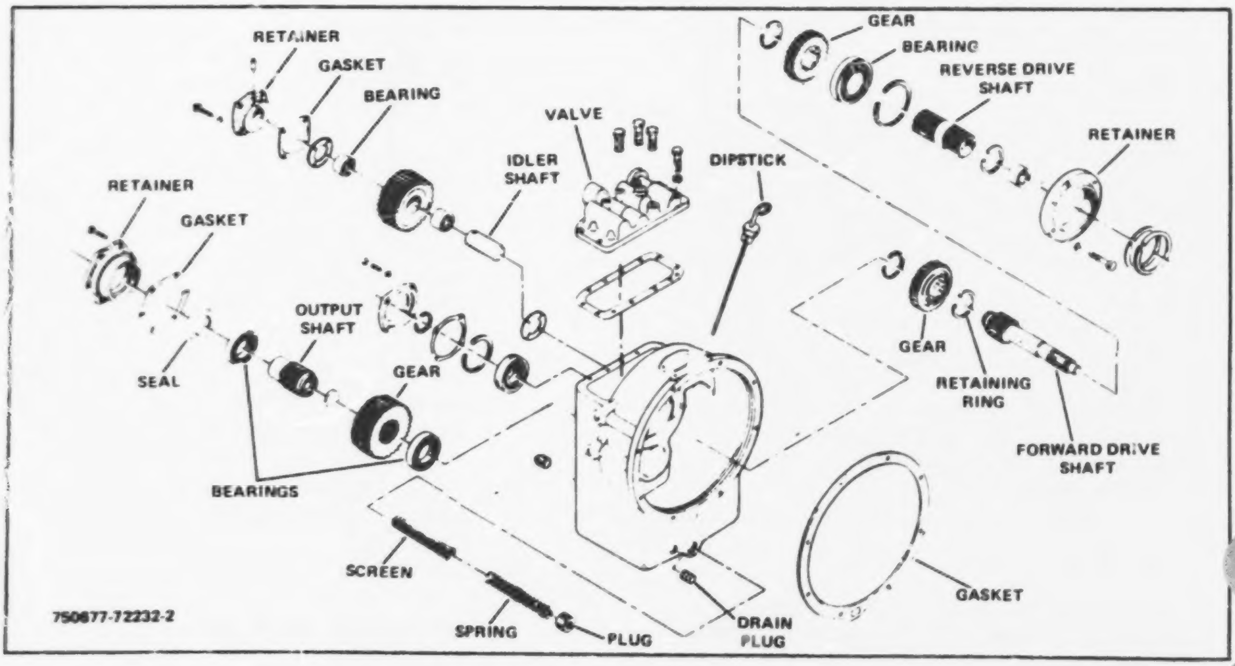

RETAINER
GASKET
BEARING
VALVE
IDLER SHAFT
DIPSTICK
GEAR
BEARING
REVERSE DRIVE SHAFT
RETAINER
RETAINER
GASKET
OUTPUT SHAFT
SEAL
GEAR
BEARINGS
GEAR
RETAINING RING
FORWARD DRIVE SHAFT
SCREEN
SPRING
PLUG
DRAIN PLUG
GASKET
750677-72232-2

Figure 1-11. Transmission

14. After installation is completed and drain plug installed, cooling lines connected and linkage installed, add 11 quarts of proper type transmission fluid to transmission.

NOTE: Oil should be changed every 1000 operating hours. Use transmission fluid as recommended. (Use quality 'A', suffix 'A'.)

15. Install seat deck assembly, floor and toe plates, front screen and air cleaner.

16. If adjustments to inching pedal or linkage are required, refer to TRANSMISSION MAINTENANCE MANUAL.

MEMO

TOPIC 2. TORQUE CONVERTER AND PUMP

As noted previously, the function of the torque converter within the "Power-Shift" transmission is to provide a fluid coupling, with torque multiplication, between the engine and transmission.

The torque converter is a sealed unit and cannot be disassembled or serviced.

A. REMOVAL - INSPECTION

1. After the transmission has been removed from the truck, carefully remove the torque converter from transmission.
2. Inspect converter housing for evidence of cuts or fractures and leaks.
3. Remove the converter oil plug, and drain from transmission any remaining oil.
4. Thoroughly clean and flush the converter with an acceptable, non-corrosive solvent. Ensure that all solvent is drained from converter prior to re-installation.

Pump:

1. Remove capscrews which mount the pump assembly to the housing and remove pump. (See Figure 1-4.)

> NOTE: It may be necessary to lightly tap the pump with a rawhide hammer during removal in order to free it from gasket.

2. Remove all capscrews holding pump to stator support and separate.
3. Remove the seal rings and oil seal. (See Figure 2-1.)
4. Remove the stator support and bushing. Install new bushing.
5. Carefully inspect pump, and if gears, bushing or housing show wear or damage, then the entire pump assembly will have to be replaced.

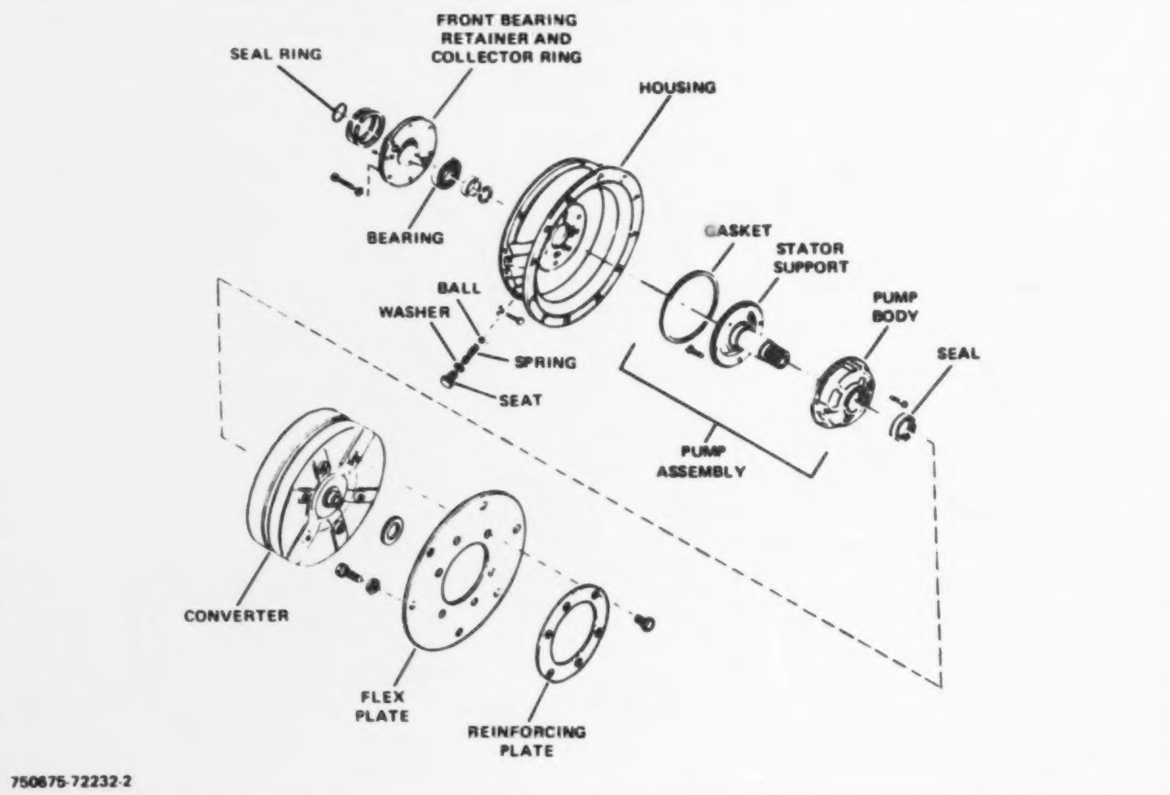

FRONT BEARING RETAINER AND COLLECTOR RING
SEAL RING
HOUSING
BEARING
GASKET
STATOR SUPPORT
PUMP BODY
SEAL
BALL
WASHER
SPRING
SEAT
PUMP ASSEMBLY
CONVERTER
FLEX PLATE
REINFORCING PLATE
750675-72232-2

Figure 2-1. Torque Converter and Pump Assembly

B. REASSEMBLY

NOTE: The converter flex plate was marked before transmission removal to show relationship with engine flywheel. Marks must be aligned when flex plate is installed.

Pump:

1. Install new seal rings and new oil seal.
2. Lubricate all parts with light engine oil.
3. Install the pump on the stator support making sure holes are properly aligned. See Figure 2-1.
4. The pump can now be installed on the converter housing. Use a new gasket and ensure that holes are properly aligned.

Converter:

CAUTION: Ensure that the transmission mounting area is free and clear of any obstacles, such as linkage and hoses to prevent damage.

1. Position the converter in the pump at the back of the transmission, making sure that the converter hub tangs properly engage pump driven gear.
2. Refer to TOPIC 1 TRANSMISSION, Paragraph G, INSTALLATION and install transmission and torque converter on engine following the instructions in that paragraph.

TOPIC 3. DRUM ASSEMBLY

The drum assembly is comprised of a drum, the forward and reverse clutches, pistons and cylinders. The clutches are engaged by oil pressure applied behind the pistons which causes engagement with the drum. The unit operates in oil at all times, both for cooling and lubrication.

It is necessary to remove the transmission in order to gain access to the drum assembly for service or repair. (Refer to TRANSMISSION REMOVAL and DISASSEMBLY

A. REMOVAL

1. Thoroughly clean outside of transmission to prevent possibility of contamination.
2. With transmission out of truck, remove the capscrews from valve assembly and remove valve assembly. Remove valve to prevent damage to valve during disassembly procedures.
3. Slide converter off the turbine shaft. Then mark the pump and the housing to ensure the proper reinstallation, and remove capscrews holding the pump and stator support to converter housing. It may be necessary to tap the pump assembly with a rawhide hammer to free it from the gasket. (See Figure 1-4.)
4. Lay the transmission on the gear case side as shown in Figure 1-5. Remove the capscrews which mount the converter housing to the gear case. Then attach a chain to the housing and remove the housing and drum assembly as a unit, taking care not to damage the seal rings in collector ring on gear case (Figure 1-5).

   To remove the converter housing from the drum, remove the snap ring on the turbine shaft and slide the housing from the drum assembly. The bearing will remain in housing. (See Figure 1-6.)

B. DISASSEMBLY

The front and rear clutch assemblies are balanced. Two lines are etched on rear clutch cylinder to indicate correct alignment of the cylinder with the piston. One etched line is

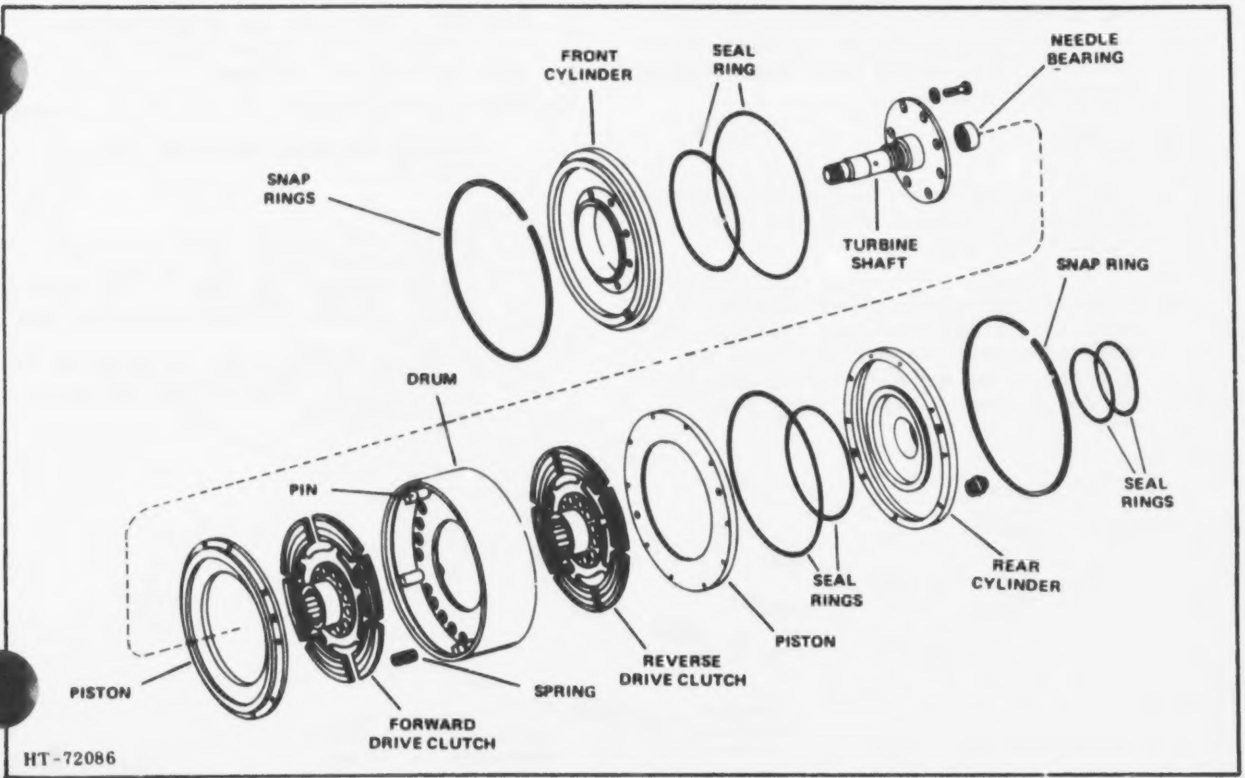

FRONT CYLINDER
SEAL RING
NEEDLE BEARING
SNAP RINGS
TURBINE SHAFT
SNAP RING
DRUM
PIN
SEAL RINGS
SEAL RINGS
REAR CYLINDER
PISTON
REVERSE DRIVE CLUTCH
SPRING
PISTON
FORWARD DRIVE CLUTCH
HT-72086

Figure 3-1. Drum Assembly

used to indicate correct alignment of forward clutch cylinder with the piston. These etched marks are not always visible. If etched marks can not be located and identified, either punch or scribe marks on the cylinders and pistons to ensure proper alignment during assembly.

1. Place the drum assembly in an arbor press. Then apply pressure on the turbine shaft until the cylinder is depressed enough to remove the large snap ring from the drum (Figure 3-1).

2. Slowly release the pressure on arbor press and remove the cylinder, making sure it is kept in alignment to prevent binding in the drum. If cylinder binds in drum, tap lightly with a rawhide hammer until it is released.

3. Remove piston, drive clutch, and springs. Ensure that piston ring is not damaged or binding.

4. Turn drum over and remove snap ring, cylinder, piston and drive clutch.

5. Examine all parts for wear or damage. Should excessive wear or score marks be evident on drive clutches, pistons or drum, they should be replaced. Check piston rings, making sure they are free in piston groove.

C. REASSEMBLY

1. Check etched or scribed marks on pistons and cylinders. Align marks before assembling clutches.

2. Install the reverse drive clutch, piston, seal rings, and rear cylinder. Make sure that the rear cylinder and the piston do not bind in the drum or on dowel pins. Install large snap ring holding cylinder and assembled parts in place. (See Figure 3-1.)

3. Turn the drum assembly over and install the springs, drive clutch, piston, seal rings and the front cylinder.

4. Place the entire assembly in an arbo press. Apply pressure on the turbin shaft, making sure cylinder does not bind in the drum or on the dowel pins. Install the large snap ring holding the front cylinder in place and when properly seated, release pressure in the arbor press.

D. INSTALLATION

1. Slide the converter housing on the turbine shaft and replace the retaing snap ring.

2. Attach a hoisting chain to the converter housing and then maneuver housing so that turbine shaft will be properly engaged as the drum and housing are reattached to transmission gear case. (See Figure 1-5).

CAUTION: Take care not to damage the seal rings in the stator support on gear case during reassembly.

Install securing capscrews and tighten.

3. Install new gasket, then align previously made marks and replace the stator support and pump on the turbine shaft. Secure with mounting capscrews.

4. Refer to TRANSMISSION INSTALLATION for CONVERTER and TRANSMISSION INSTALLATION procedure.

TOPIC 4. CONTROL VALVE

The direction of travel of the truck is obtained by operating a control valve which is mounted on the transmission housing. The valve controls the pump pressure, direction of travel and inching.

When control valve repair or replacement is necessary, the following procedure should be used:

A. REMOVAL

> NOTE: It is not necessary to remove the transmission from the truck in order to service or replace the control valve.

1. Remove floor plate.
2. Disconnect the control linkage at the control valve. Remove return to neutral mechanism.
3. Clean valve and surrounding area to keep contaminants out of transmission.
4. Disconnect wires from neutral start switch.
5. Disconnect tube assembly from valve. Plug or cap tube to prevent contamination.
6. Loosen the control valve mounting capscrews and remove control valve assembly. Remove and discard gasket, then place a clean covering over exposed area of transmission to prevent contamination.
4. Place control valve assembly in a clean work area for disassembly.

B. DISASSEMBLY

1. After control valve has been removed from transmission housing, make sure all dirt and foreign material is removed from the valve body.

> NOTE: Take care not to damage valve body during disassembly. Use tools properly.

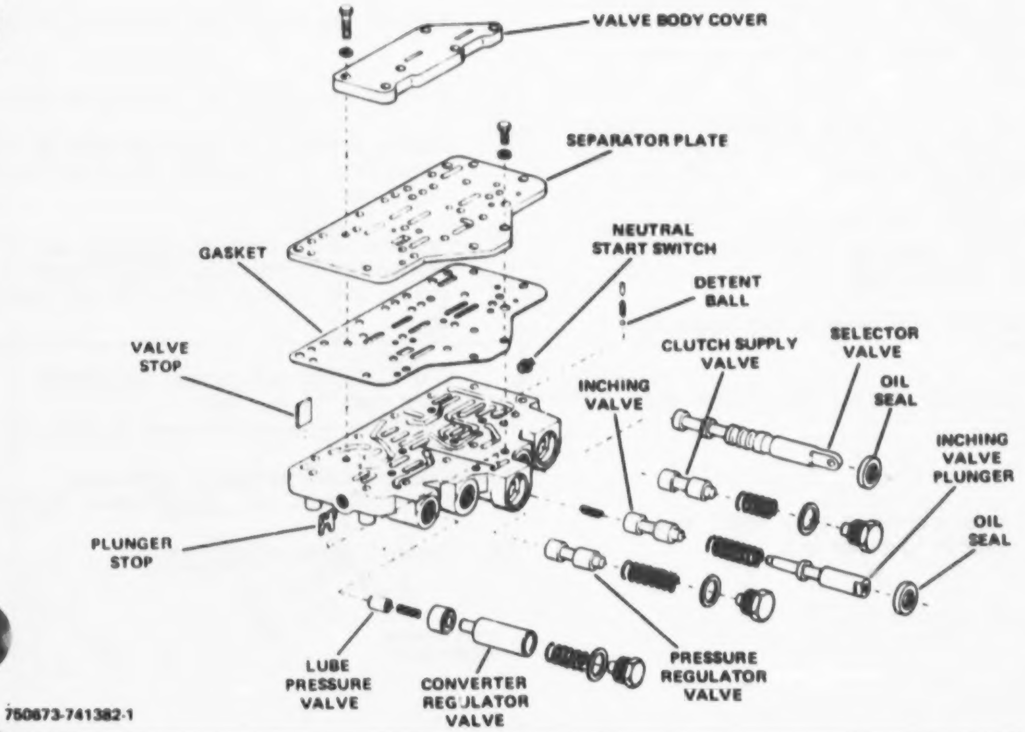

VALVE BODY COVER
SEPARATOR PLATE
GASKET
NEUTRAL START SWITCH
DETENT BALL
VALVE STOP
CLUTCH SUPPLY VALVE
SELECTOR VALVE
INCHING VALVE
OIL SEAL
INCHING VALVE PLUNGER
OIL SEAL
PLUNGER STOP
PRESSURE REGULATOR VALVE
LUBE PRESSURE VALVE
CONVERTER REGULATOR VALVE
750673-741382-1

Figure 4-1. Control Valve

2. Remove neutral start switch.

3. Remove screws and remove valve body cover. (See Figure 4-1).

4. Remove capscrews at the front of separator plate and remove plate and gasket.

5. Remove the spring, detent ball and retainer from the valve body at the selector valve spool.

6. Remove the selector valve spool.

7. Remove the inching control plunger by first removing the lock-clip and seal, then the springs and the spool from the inching control valve. Note small spring in spool.

8. Remove the cap at the pressure regulator valve and remove the spring and spools from valve body.

9. Remove the cap at the clutch valve, and remove the spring and spool from valve body.

10. Remove the cap from the converter regulator valve and remove spring, valve and plug.

11. Remove valve stop plate through the bottom of the valve. Remove spring and lube pressure valve through converter regulator valve bore.

12. Clean all parts with an acceptable solvent and dry with compressed air. Blow out all passages in valve body.

13. Check plungers and spools for score marks; if possible, clean up with crocus cloth. If badly scored, replace.

14. Check springs for damage. Replace, if necessary.

15. Replace all oil seals, seal rings and gaskets.

C. REASSEMBLY

1. Install dump clutch supply spool and spring, gasket and end cap.

2. Replace pressure regulator valve spool, spring, gasket and end cap.

3. Install small spring in inching contro spool, then replace spool and large sp Replace the inching control plunger by pus ing in against plunger, then releasing aft anchoring plunger with plunger stop.

4. Install the selector valve spool.

5. Replace the selector valve detent ball, spring and retainer.

6. Install lube pressure valve and spring in converter regulator valve bore. Install valve stop plate through bottom of valve.

7. Install plug, pressure regulator valve, spring and end cap.

NOTE: Ensure that all plungers and spools operate freely and that the inching control plunger retainer is installed with the angled edges facing towards the rear of the valve body.

8. Install new gasket and replace the separator plate and capscrews.

9. Install the cover and secure with ca

10. Install neutral start switch in valve.

11. Remove protective covering over exposed area of transmission, then install new gasket.

12. Replace valve control assembly on transmission housing, install capscrews and torque to 5 - 10 ft. lbs.

CAUTION: Do not torque capscrews more than 10 ft. lbs.

13. Connect tube assembly to valve. Connect wires to neutral start switch.

14. Install floor plate.

TOPIC 1. UNIVERSAL JOINT

A. GENERAL

The purpose of the universal joint assembly is to transfer the transmission output power to the drive wheels of the truck. The universal joint assembly is the heavy duty industrial type which consists of a drive shaft or center plate, two cross assemblies, a transmission output flange, and the necessary hardware.

Very little service is required for the universal joint assembly, other than periodic lubrication of the cross assembly bearings. Also, it is recommended that the torque of capscrews be checked every 100 hours of operation. The mounting capscrews that secure the cross assemblies to the drive shaft or center plate, and the joint attaching capscrews must be tightened to specified torque of 25-30 lb-ft DRY THREADS, or 20-24 lb-ft LUBRICATED THREADS.

B. REMOVAL

1. Raise and securely block the lift truck to gain access to the universal joint assembly.
2. At the transmission end of the assembly, remove the capscrews that attach the cross assembly to the output flange.
3. At the differential end of the assembly, remove the capscrews that attach the cross assembly to the differential carrier flange.
4. Remove the entire universal joint assembly from the lift truck.
5. Remove the output flange from the transmission.

C. DISASSEMBLY - INSPECTION

1. Remove the mounting capscrews and remove the cross assemblies from the drive shaft or the center plate (depending upon the length of the universal joint assembly).

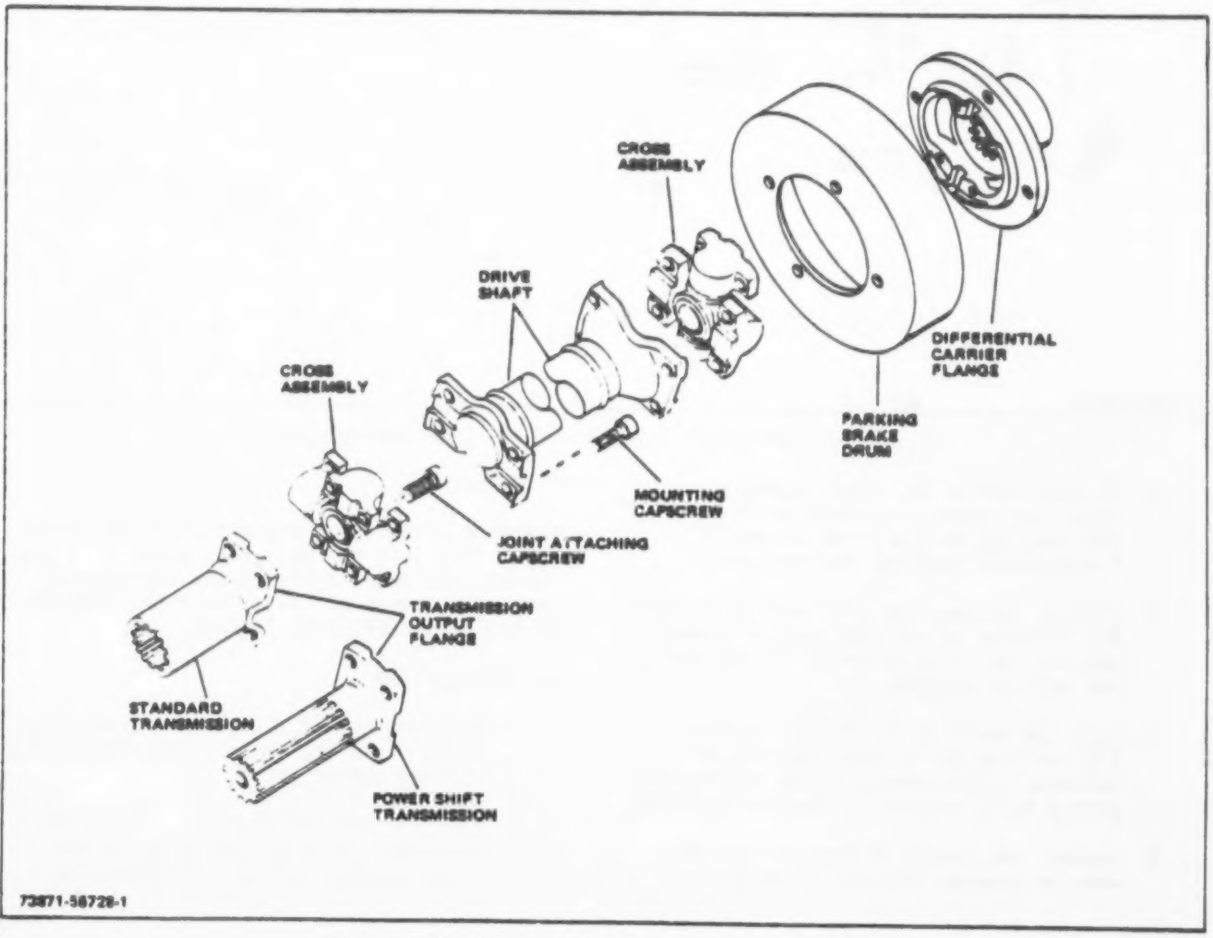

CROSS ASSEMBLY
DRIVE SHAFT
CROSS ASSEMBLY
DIFFERENTIAL CARRIER FLANGE
PARKING BRAKE DRUM
MOUNTING CAPSCREW
JOINT ATTACHING CAPSCREW
TRANSMISSION OUTPUT FLANGE
STANDARD TRANSMISSION
POWER SHIFT TRANSMISSION
73871-58728-1

Figure 1-1. Universal Joint Assembly (Typical)

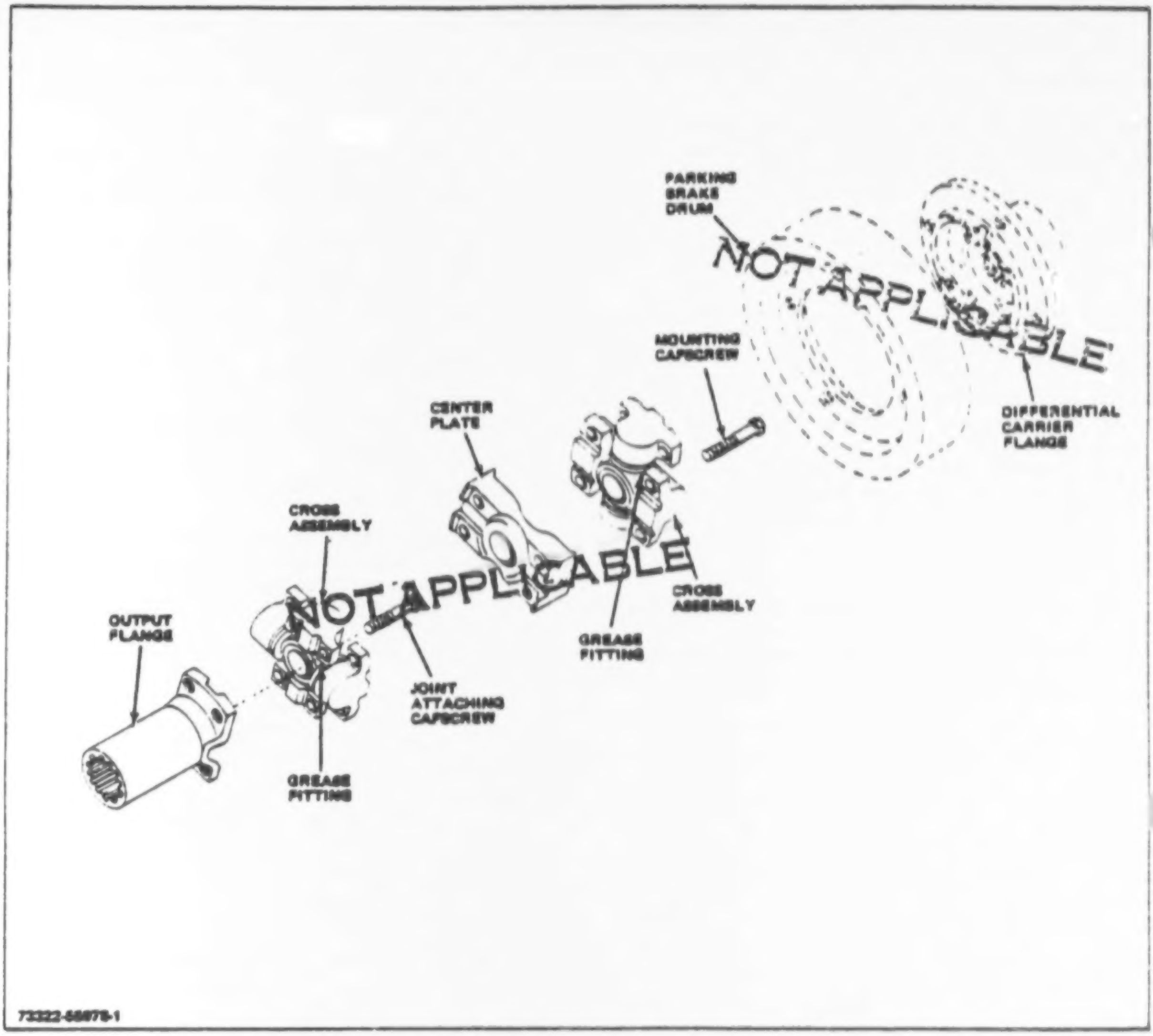

PARKING BRAKE DRUM
NOT APPLICABLE
MOUNTING CAPSCREW
DIFFERENTIAL CARRIER FLANGE
CENTER PLATE
CROSS ASSEMBLY
NOT APPLICABLE
CROSS ASSEMBLY
GREASE FITTING
OUTPUT FLANGE
JOINT ATTACHING CAPSCREW
GREASE FITTING
73322-66878-1

Figure 1-2. Universal Joint Assembly (ACP 100-120-140)

2. To disassemble the cross assembly, break the connecting strap which holds the bearings on the cross assembly. These straps need not be replaced.

3. Inspect the bearings and bearing surfaces for evidence of extreme wear or damage. Replace the cross assembly if any parts are worn or damaged.

4. Pack the bearings thoroughly with a high melting point wheel bearing or universal joint grease. Make certain the grease fully covers all bearing surfaces.

5. Inspect the output flange splines for wear or damage; replace if necessary.

D. REASSEMBLY

Reassemble the cross assemblies to the drive shaft (Fig 1-1) or the center plate (Fig 1-2). Install the mounting capscrews and tighten them to a torque of 25-30 lb-ft DRY THREADS, or 20-24 lb-ft LUBRICATED THREADS.

E. INSTALLATION

1. Position output flange on transmission shaft or in the transmission internally splined output drive.

2. Position the differential end of the universal joint so the holes in the cross assembly align with the holes in

the differential carrier flange. Insert capscrews and tighten them to specified torque of 25-30 lb-ft DRY THREADS, or 20-24 lb-ft LUBRICATED THREADS.

3. Position transmission end of universal joint so holes in cross assembly align with holes in output flange. Insert capscrews and tighten them to specified torque of 25-30 lb-ft DRY THREADS, or 20-24 lb-ft LUBRICATED THREADS.

NOTE: Make certain ALL CAPSCREWS are tightened to SPECIFIED TORQUE.

4. Remove blocks supporting the lift truck and lower the truck to the floor.

MEMO

DRIVE AXLE

TOPIC 1. DRIVE AXLE

A. DESCRIPTION

The drive unit is a double reduction, internal gear drive within wheel, and a spiral bevel in axle housing. The drive wheels are mounted on an axle housing spindle by two opposed tapered roller bearings, locked in correct adjustment by a washer, a castellated nut and cotter pin. The weight of the truck is carried by the axle housing, and through the wheels (See Figure 1); therefore, the axle shafts serve only to drive the wheels.

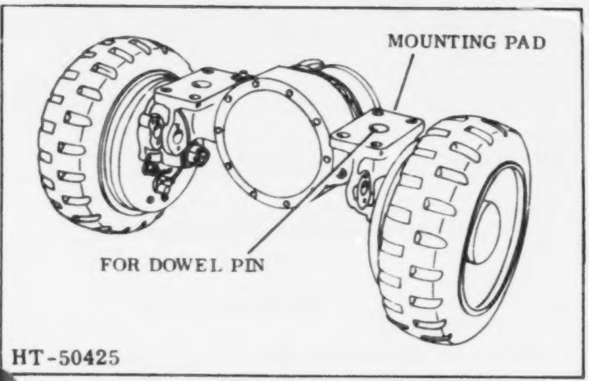


Figure 1. Drive Axle Assembly (Typical)

The differential is of the bevel gear and pinion type with the final drive reduction through the axle shafts (jackshaft) and bull gears (Figure 2), setting each drive wheel into motion. In order to hold the differential assembly rigidly in place in the housing, it is mounted on two studs and then held firmly in position by self-locking capscrews.

The axle shafts (jackshaft) are splined to the differential side gears at one end and mesh with the bull gear in the drive wheel at the opposite end. The axle shaft teeth are crown-shaved to ensure proper meshing with the bull gear. The axle shafts rotate at the drive wheel end in two opposed tapered roller bearings, which are locked in place on the shafts by a sleeve type nut and spider lock ring. The assembly is locked in position in the axle housing by a bearing cap and capscrews.

The bull gear is correctly located in the drive wheel by roll pins and is bolted into the wheel from the outside so that tightness can be checked periodically without the necessity of removing the wheel.

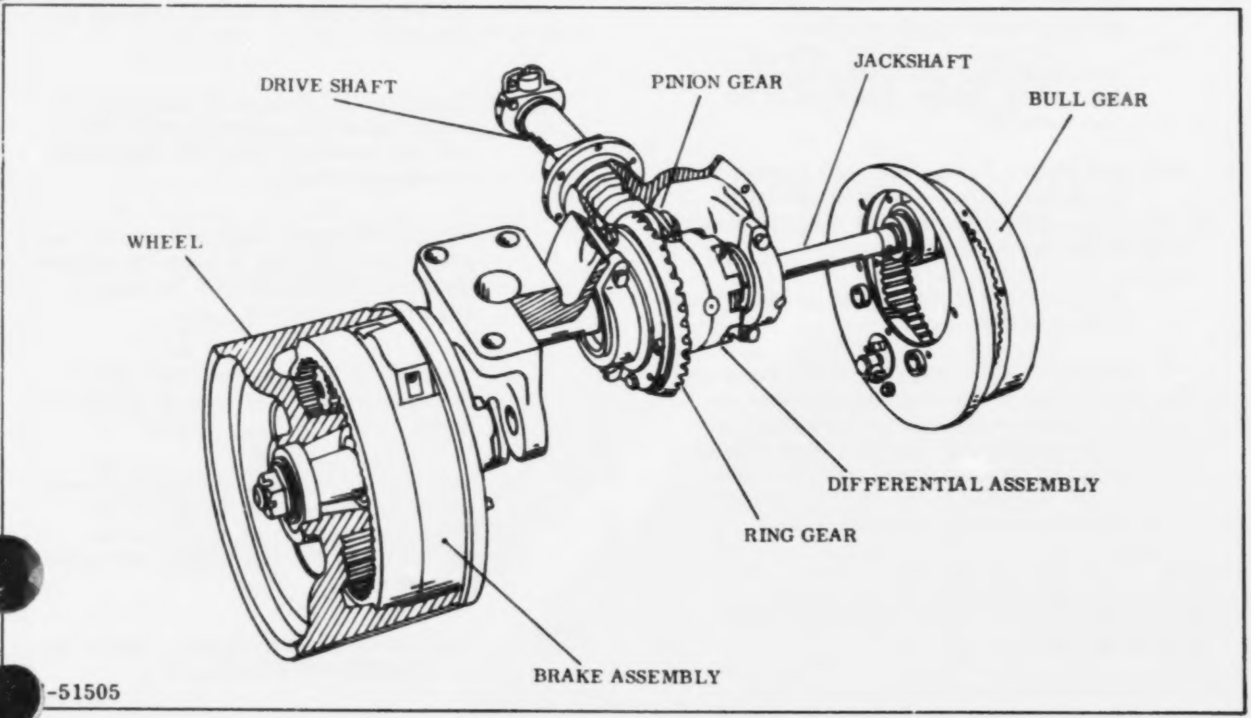


Figure 2. Drive Unit Components (Typical)

best copy available
Reproduced from poor document.

B. DRIVE UNIT SERVICE

Jackshafts and bearings, bull gears and wheel bearings should be inspected and serviced at periodic intervals. All parts should be checked for any possible damage or excessive wear. The level of the oil in the differential housing should be checked, and also changed when specified.

The housing breathers should be kept clean and open to prevent any pressure from building up in the unit.

NOTE: Refer to the LUBRICATION AND SERVICE GUIDE for specific instructions regarding lubrication of the drive unit.

The drive unit can be removed as an assembly, if desired. It will be necessary to remove the mast assembly in order to remove the drive unit. The following procedure is recommended for drive unit removal:

1. Removal

   a. After the mast has been removed (see MAST REMOVAL), disconnect the main hydraulic brake line at the junction block located on the differential housing. Disconnect the hydraulic lines, the leakage return line, or any other lines which are attached to the drive unit housing.

   b. Disconnect the emergency brake cable by removing the clevis pin from the parking brake actuating lever.

   c. Disconnect the universal joint (see U-JOINTS), leaving slip joint in the transmission.

   d. See Figure 3 and attach hoist chain hooks in the tilt cylinder holes in the front plate. Pull chain snug to take the weight of the truck off drive axle.

   e. Remove all mounting bolts and capscrews from mounting pads.

   f. Raise the truck away from the drive unit and remove drive unit from under the truck frame. It may be necessary to apply pressure at the mounting pads in order to free the drive unit from the truck, because of the tight fit of the dowel pins in the mounting pads.

NOTE: For service instructions on the drive unit assembly, refer to DRIVE UNIT DISASSEMBLY.

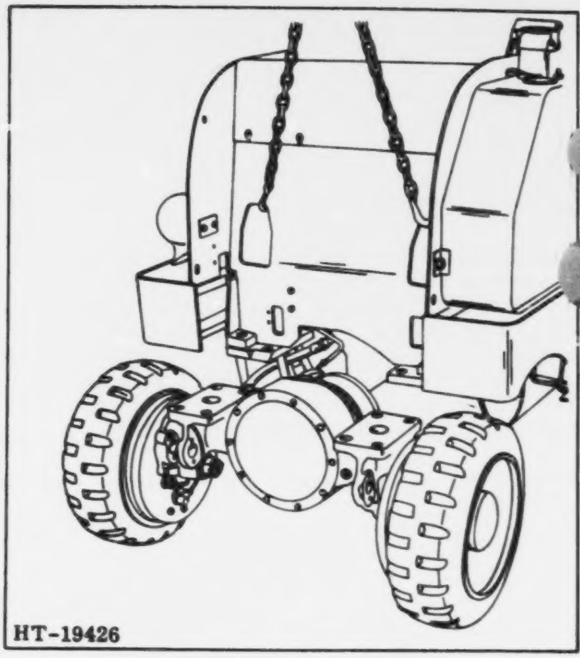

HT-19426

Figure 3. Drive Unit Removal

2. Installation

   a. To replace the drive unit assembly, carefully raise the truck body high enough with hoisting chain to position drive unit under front end at dowel pin location.

   b. Lower truck frame until it is securely supported at the mounting pads and insert all mounting bolts and capscrews previously removed.

   c. Connect universal joint and ensure that drive shaft coupling is properly aligned. (Refer to TRANSMISSION for proper alignment procedure.)

   d. Connect the emergency brake cable by replacing the clevis pin at actuating level.

   e. Securely tighten all mounting hardware and hose connections and bleed the hydraulic brake system. (Refer to HYDRAULIC BRAKE Section for prope procedure.)

   f. Replace the mast assembly. (Refer to MAST ASSEMBLY Section.)

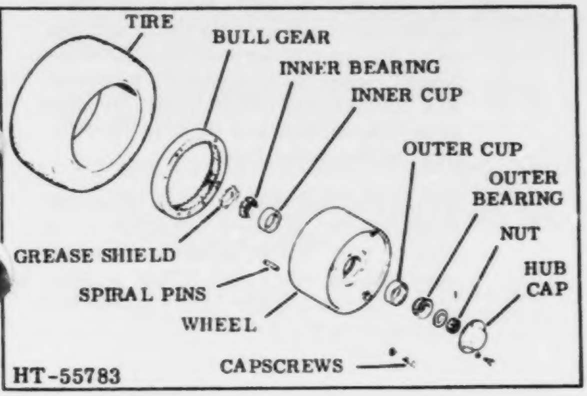

TIRE
BULL GEAR
INNER BEARING
INNER CUP
OUTER CUP
OUTER BEARING
NUT
HUB CAP
GREASE SHIELD
SPIRAL PINS
WHEEL
CAPSCREWS
HT-55783

Figure 4. Drive Wheel Assembly

C. DRIVE UNIT DISASSEMBLY/REASSEMBLY

The following operations may be performed without removing the drive unit from the truck.

1. Drive Wheel Removal

   The wheel assembly consists of the wheel, tire, brake drum, wheel bearings and the bull gear. (Figure 4.)

   To remove the wheel:

   a. Raise the truck sufficiently so that the drive wheel clears the floor. This may be done by tilting the mast to its full backward position and inserting a block under the mast assembly, then tilting mast to its vertical position. (See Figure 5.)

   b. Remove capscrews, lockwashers and hub cap. Remove cotter pin, washer and retaining nut. The outer wheel bearing can now be removed.

   c. After the outer wheel bearing has been removed, the wheel can be removed. (See Figure 6.)

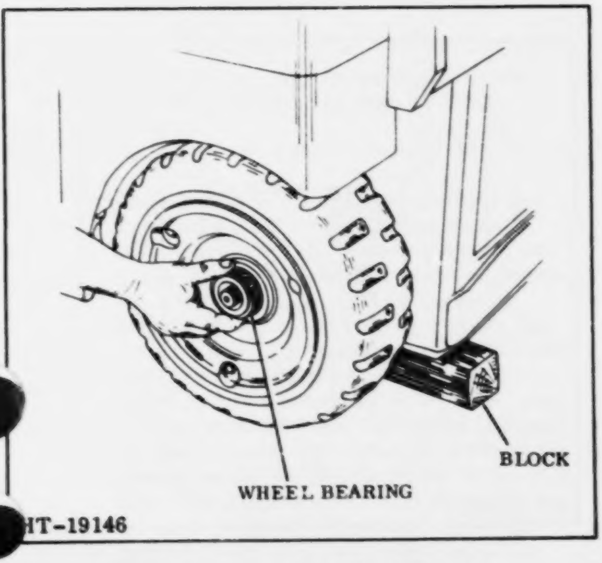

BLOCK
WHEEL BEARING
HT-19146

Figure 5. Removing Wheel Bearing

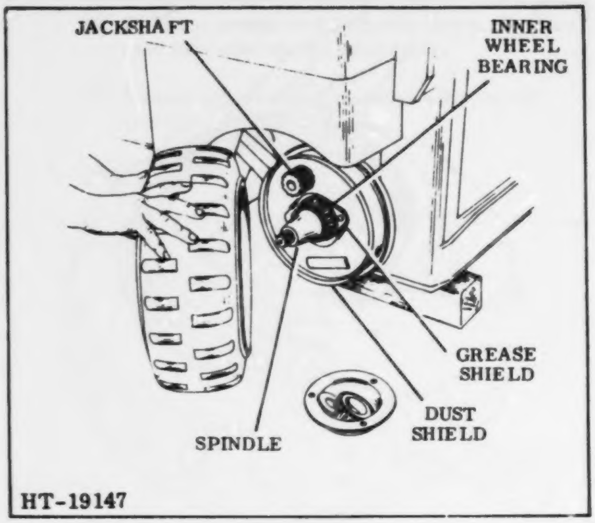

JACKSHAFT
INNER WHEEL BEARING
GREASE SHIELD
DUST SHIELD
SPINDLE
HT-19147

Figure 6. Removing Drive Wheel

CAUTION: When removing wheel, exercise care so that no damage to the drum or brake shoes occurs.

   d. After the drive wheel has been removed, the inner wheel bearing and the grease shield can be removed.

2. Inspection - Service

   Using a solvent, wash all grease from the bearings and bearing surfaces. Inspect for worn or damaged parts and replace where necessary.

   a. Replacing Bearing Cups

   (1) Recesses are provided on the inner hub of the drum; insert a brass drift at these points, tap lightly with a hammer and remove cup.

   (2) When replacing bearing cups, set in hub with taper to the outside of the wheel. Using a brass drift, tap evenly around the edge of the cup, exercising care so that the cup will not bind (bearing press can also be used for installation).

NOTE: Bearing cup should be a press fit.

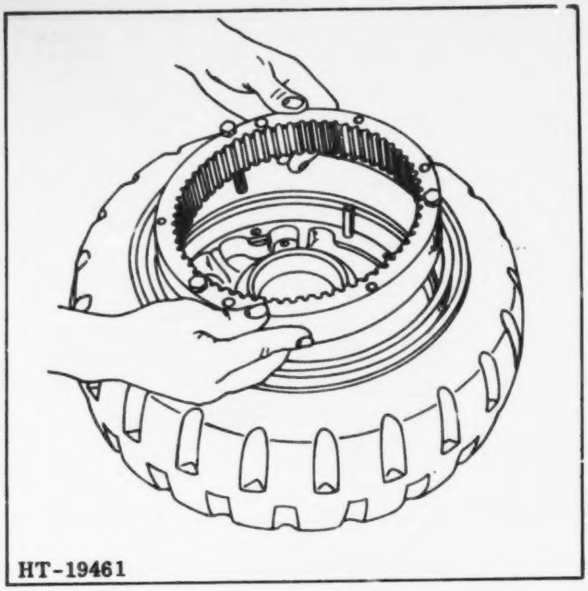


Figure 7. Bull Gear Removed

b. Replacing Bull Gears

(1) Remove the three capscrews which bolt the bull gear to the inner side of the wheel.

(2) Turn the wheel over and using standard, hardened capscrews with three inches of thread, insert in the holes provided in the bull gear. (Figure 7.)

(3) Tighten the capscrews evenly until the bull gear is removed from the wheel bore.

(4) Inspect the bull gear for any broken or worn teeth or cracks in the ring. Replace if damaged.

(5) To prevent any damage to the bull gear when installing the spiral pins, the edge of the outer coil should lie on the bolt circle diameter as shown in Figure 8.

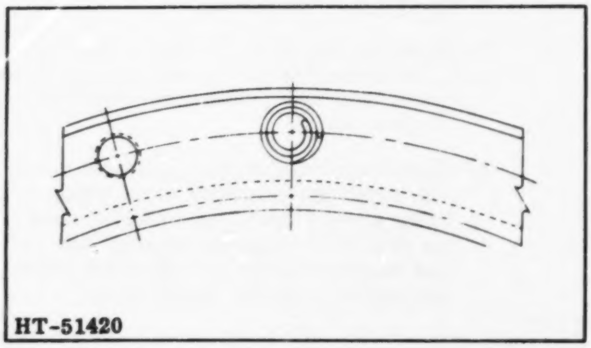


Figure 8. Spiral Pin Installation

(6) To reinstall the bull gear, align the spiral pin holes and the pins, and tap until the gear is started into the wheel. Install capscrews originally removed and continue gear installation by tightening capscrews and tapping the bull gear at the same time.

(7) To ensure that the bull gear is seated correctly in the wheel bore, try to insert a .003" feeler gauge between the gear and the shoulder. When the gear is properly seated, the feeler gauge will not enter at any point.

c. Replacing Solid or Cushion Tire

The wheels used on all cushion tire lift trucks are machined from a casting. Any misalignment of the wheel and tire, while pressing the wheel into the tire, can cause possible damage to the wheel. Because of this, a chamfer has been provided on the outside edge of the wheel and on either end of the metal insert located on the inside diameter of the tire. The chamfers help center the wheel and tire for pressing and reduce the possibility of any misalignment. The chamfered edge of the wheel must always be the leading edge of the wheel when the wheel is being pressed into the tire.

When replacing worn or damaged tires the wheel chamfer is not noticeable. To assure that the chamfered edge enters the new tire first always position the new tire on top of the wheel and tire assembly with the outside of the wheel and tire assembly up.

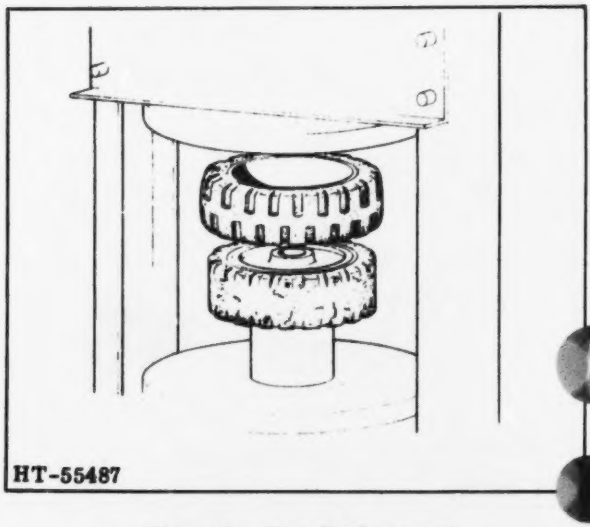


Figure 9. Tire Replacement

The following procedure is recommended to replace cushion tires.

(1) Remove wheel and tire assembly from lift truck.

(2) Check inside diameter of new tire. Remove any signs of scale or rust with sandpaper. Lubricate inside of new tire with bearing grease.

(3) Place a circular ram on the press table. The length of the ram must be greater than the width of the tire to allow complete removal of the old tire. The outside diameter of the ram must be large enough to rest squarely on the bull gear's flat surface .

(4) If the outside edge of the wheel is not flush with the edge of the metal insert in the old tire, measure how far wheel is recessed inside the tire. New tires must be replaced to the same position as the worn tire was installed on the wheel. A spacer, slightly smaller in diameter than the inside diameter of the tire and the same thickness as the depth of the recess, can be used to obtain the proper amount of recess.

(5) Center worn tire and wheel assembly over ram, be sure ram and wheel "mate-up" squarely.

(6) Position new tire on top of wheel and tire assembly. Align new tire and wheel and tire assembly to be concentric with each other. Make certain the outside of the wheel is positioned upwards, because the outside edge of the wheel has a slight chamfer to help guide the wheel into the new tire.

NOTE: The tire can only be installed in one direction without risking damage to the wheel.

(7) Start pressing new tire onto wheel and worn tire off the wheel. Run press slowly for the first inches of travel because this is the critical stage of pressing wheel into tire. If tire begins to cock, stop press and realign wheel and tires, a sharp jar with a mallet will normally realign wheel and tire. If the wheel is to be recessed in the tire, stop hydraulic press after the wheel has been started into the new tire and position the spacer on the inside diameter of the new tire. The spacer must rest squarely on the outer edge of the wheel. Continue pressing new tire onto wheel until tire is correctly positioned on wheel.

(8) Release press and remove tires. Inspect new tire and wheel assembly.

(9) Install wheel and tire assembly on lift truck.

3. Jackshaft Service

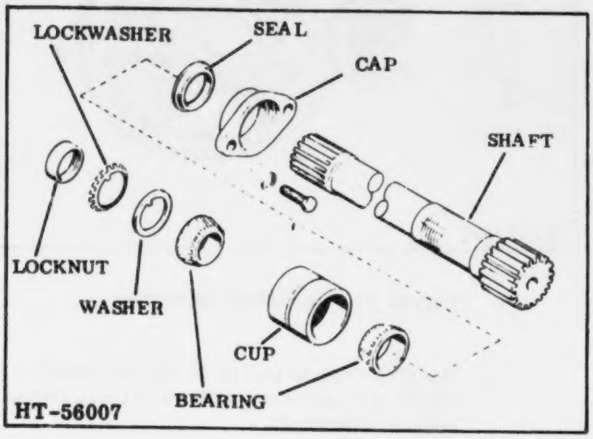


Figure 10. Jackshaft Assembly

The jackshaft is the connection between the differential assembly (first reduction) and the bull gear in the drive wheel (second reduction). The jackshaft is supported by two opposed, tapered roller bearings; its splined end fits into the differential and the opposite pinion end drives the wheel through the bull gear. To remove the jackshaft, proceed as follows:

a. Remove wheel. (See WHEEL REMOVAL.)

b. Remove capscrews which secure the jackshaft dust shield.

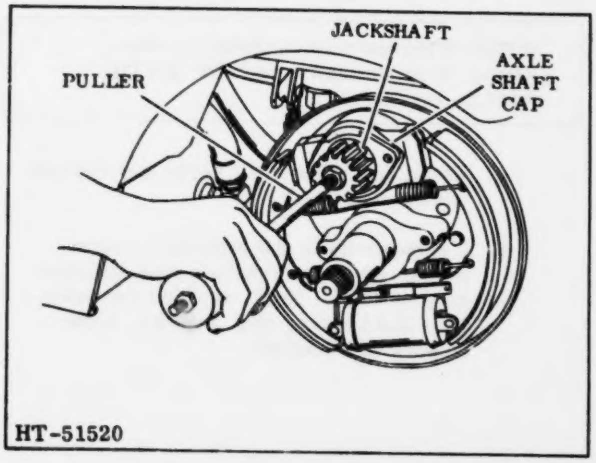


Figure 11. Pulling Jackshaft

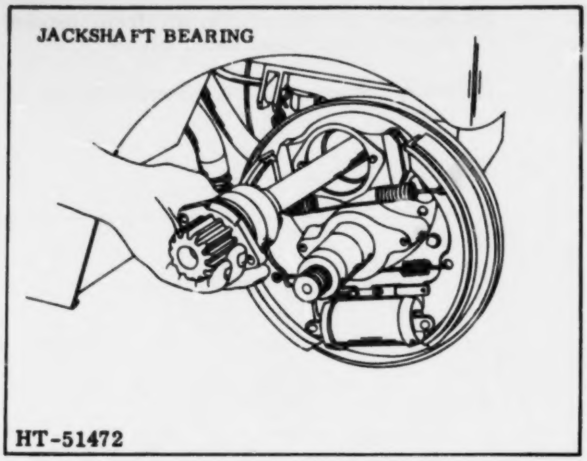


Figure 12. Jackshaft Removed

c. Install a weight puller in the threaded end of the jackshaft and exercising care, remove the shaft.

NOTE: The bearing assembly will be removed with the jackshaft. Figure 12.

d. Straighten the locking prongs of the lockwasher (Figure 10) and remove locknut lockwasher.

e. Place the shaft in a suitable press and force the bearings from the shaft.

CAUTION: Exercise care to prevent damaging the axle shaft cap.

f. After bearings and bearing cup are removed, slide the retainer cap from the shaft.

NOTE: Whenever the jackshaft is removed, it is recommended that the oil seals be replaced.

g. Clean and inspect all parts and replace where necessary.

h. To reassemble the jackshaft components. slide the retainer ring and new seal on shaft. Next, replace the bearings and bearing cup, washer, lockwasher and locknut.

i. Ensure that bearings have been properly packed with grease, then tighten locknut so there is a slight drag on the bearings. Lock the nut in position by bending prongs of lockwasher over.

j. To reinstall the jackshaft, place in position in the drive housing. Then, using a soft mallet, drive the shaft in place, and at the same time align the holes in the retaining cap with the holes in housing. Install and tighten capscrews.

k. Replace wheel.

4. Spindle Service

To remove the drive wheel spindle, proceed as follows:

a. Remove wheel. (See WHEEL REMOVAL).

b. Remove dust cover.

c. Remove the cotter pin, locknut and washer from the spindle at the back side of the drive housing.

d. Install a spindle puller as shown in Figure 13 and remove the spindle.

e. Carefully inspect the spindle for any evidence of uneven wear or damage. Replace if worn, chipped or bent.

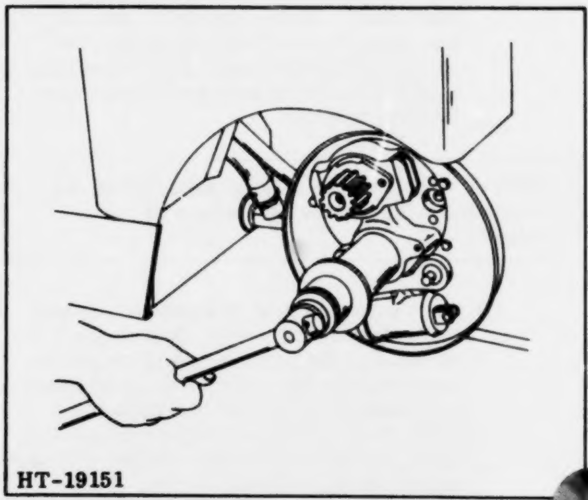


Figure 13. Removing Spindle

f. To replace spindle, align the spindle in the drive housing and replace the washer and locknut. Tighten the nut until the spindle fully seats, then install the cotter pin.

g. Install the dust shield and the wheel assembly.

h. Tighten wheel bearing nuts as follows: Using a torque wrench, tighten nuts in accordance with chart below; just before reaching maximum torque, turn each wheel six times in both directions, then back nut off 30° minimum to 60° maximum so cotter pin can be installed.

TORQUE VALUES:

FT20-25-B30	90 ft. lbs.
F30-40-50	120 ft. lbs.
FP40-50	120 ft. lbs.
F-FS60-70	120 ft. lbs.
FTP20-30	150 ft. lbs.
F-FS80	150 ft. lbs.
F100-120	200 ft. lbs.

TOPIC 2. DIFFERENTIAL

A. DESCRIPTION

The differential case and carrier consists of two parts, the carrier assembly and the differential assembly. (See Figure 14). The carrier assembly is mounted at the center of the drive unit housing, and encloses the pinion gear from the drive shaft. The bevel ring gear is bolted to the differential case and the case in turn houses the spider gears.

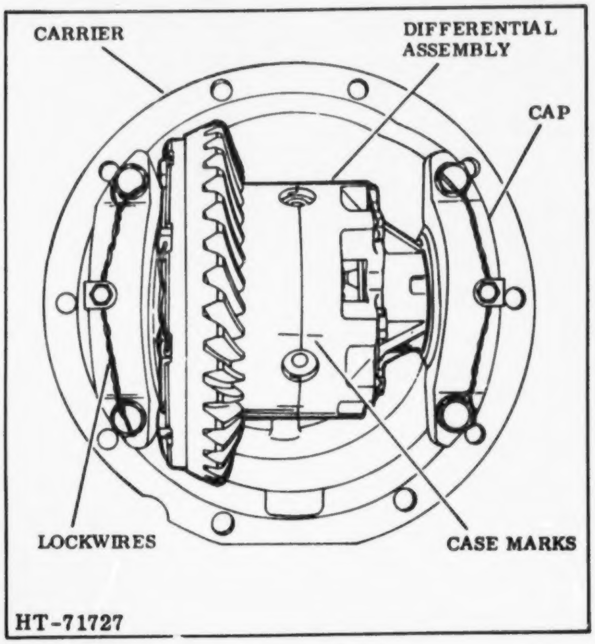


Figure 14). Differential and Carrier Assembly

It is the purpose of the differential and carrier assembly to accept and translate the driving torque from the drive shaft coupling to the drive wheels of the lift truck, thus moving the truck in a forward or reverse direction. The following procedure is recommended to remove the differential assembly from the carrier.

B. REMOVAL

1. Remove the drive wheels; refer to DRIVE WHEEL REMOVAL.
2. Remove the jackshafts; refer to JACKSHAFT REMOVAL.
3. Remove U-Joint and drive shaft coupling; refer to U-JOINTS, REMOVAL.
4. Remove drain plug at bottom of differential housing assembly and drain oil.
5. Remove the parking brake cable at the brake actuating lever and disconnect the hydraulic lines or leakage return line if they might hinder differential and carrier assembly removal.
6. Remove the securing capscrews which mount the carrier and differential assembly to the axle housing.

WARNING: Be sure to properly support the carrier assembly as the capscrews are removed.

7. Carefully withdraw the carrier and differential assembly from the axle housing and place on a suitable workbench.

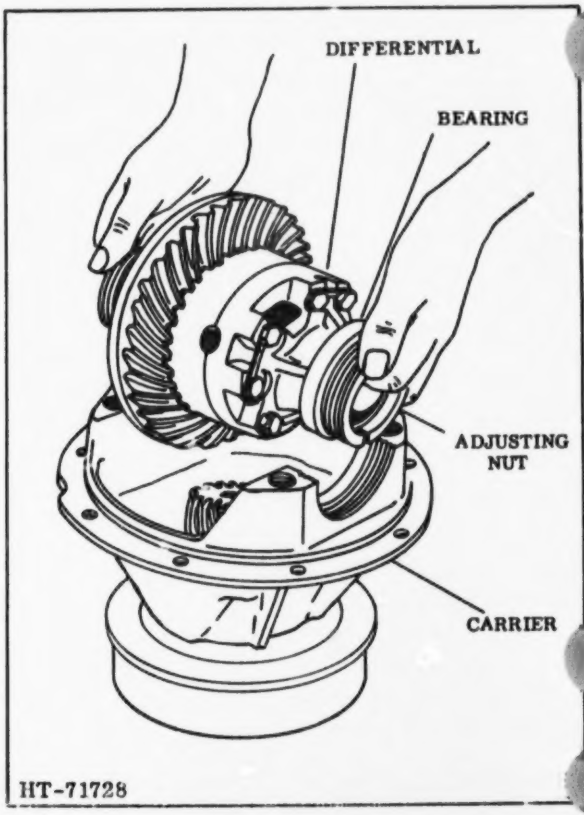


Figure 15). Removing Differential from Carrier

NOTE: It may be necessary to lightly tap the carrier housing in order to free it from seal.

8. Remove and discard gasket between carrier housing and axle housing.

9. Mark the bearing caps and differential housing (Figure 14) to aid in proper alignment during reassembly; then remove the lockplates, securing capscrews, cotter pins and the retaining bearing caps.

10. Refer to Figure 15 and remove the differential case assembly along with the adjusting nuts, bearings and bearing cups.

C. DISASSEMBLY - PINION DIFFERENTIAL. See Figure 16.

Pinion Removal

1. Remove cotter pin and pinion flange nut.
2. Remove pinion flange and parking brake drum.
3. Place carrier in press and remove pinion from carrier. Spacer and shims will be removed along with pinion.

NOTE: Do not lose or damage shims as these may be used upon reinstallation, providing carrier housing is not replaced.

4. If pinion shaft front bearing must be replaced, remove with suitable puller.
5. To remove rear pinion shaft bearing from carrier, use brass drift and tap out with hammer. Oil seal will also be removed at

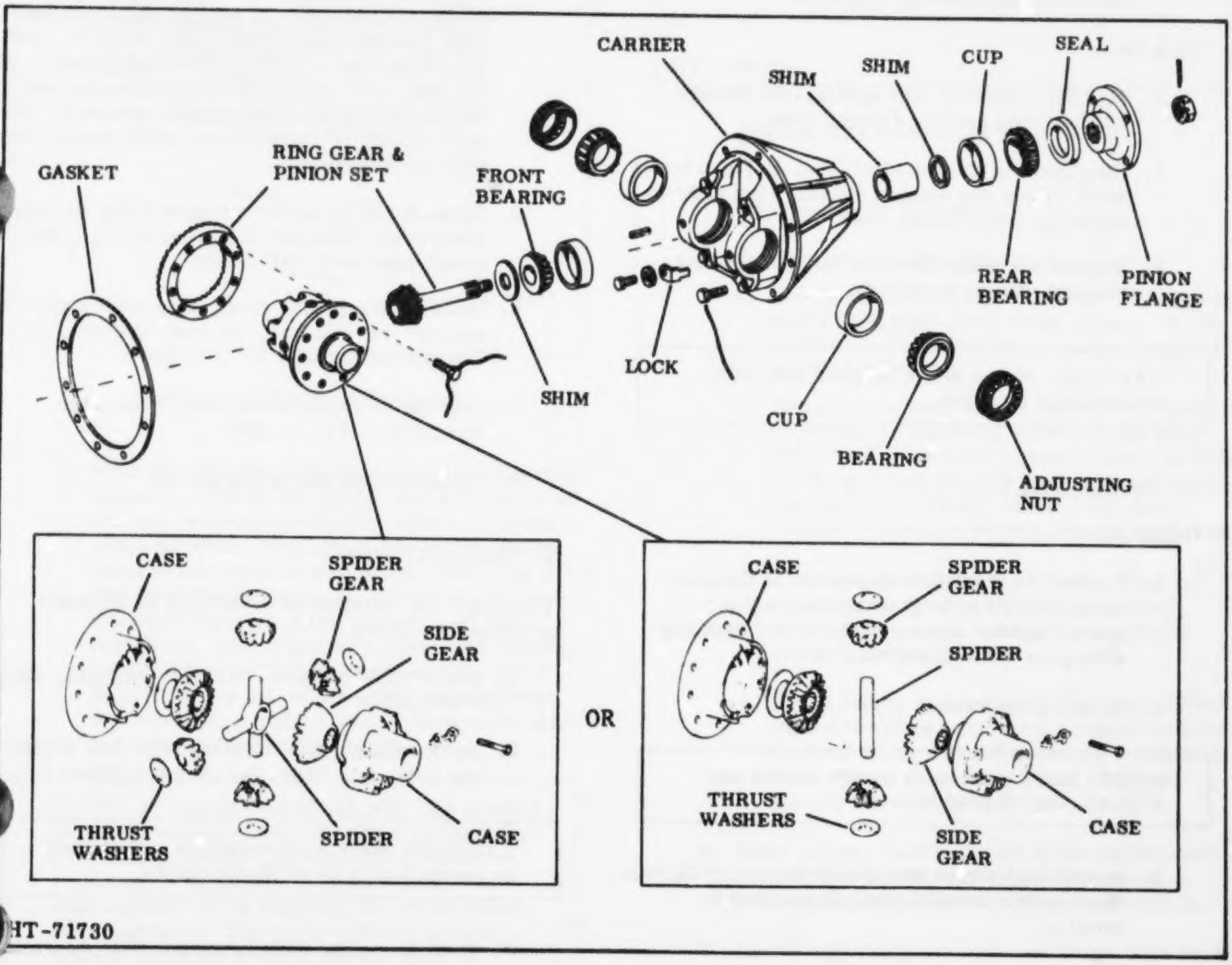

CARRIER
SHIM
SHIM
CUP
SEAL
GASKET
RING GEAR & PINION SET
FRONT BEARING
REAR BEARING
PINION FLANGE
LOCK
SHIM
CUP
BEARING
ADJUSTING NUT
CASE
SPIDER GEAR
SIDE GEAR
THRUST WASHERS
SPIDER
CASE
OR
CASE
SPIDER GEAR
SPIDER
THRUST WASHERS
SIDE GEAR
CASE
HT-71730

Figure 16. Differential Carrier and Assembly

same time. Whenever oil seal is removed, it should be replaced with a new seal.

6. To remove front bearing cup from carrier, tap out with brass drift.

7. Inspect all bearings and pinion shaft for damage and excessive wear. Replace where necessary.

> NOTE: Pinion and ring gear may only be replaced as a set.

Differential

1. Remove bearings with suitable bearing puller where necessary.

2. Remove lockplates and capscrews holding case halves together. Note aligning marks on case halves.

3. Remove plain case. Spider gears and thrust washers may then be removed.

Ring Gear

1. Remove lockwire and special cap screws holding ring gear to flanged case.

2. Ring gear is doweled in place. Using a brass drift, drive out dowels causing ring gear to separate from flange case.

3. Inspect all parts for wear or damage and replace where necessary.

> CAUTION: Pinion and ring gear may only be replaced as a set.

D. REASSEMBLY

Differential

1. Place thrust washer in bottom of flanged case. Install side gear spider, spider gears, spider thrust washers and opposite side gear with thrust washer.

3. Install plain case.

> NOTE: Make sure case match marks are aligned. See Figure 14.

3. Install lockplates and capscrews, and tighten. Bend lockplate tabs over capscrews to secure.

4. Install bearings, if removal was necessary.

Ring Gear

1. When reinstalling ring gear, position two dowels in ring gear and align ring gear with dowel holes in flange case.

2. Install special capscrews and draw ring gear in place, tighten capscrews and lock with lockwires.

Pinion Gear

1. Press front and rear bearing cups into differential carrier. Be sure they are firmly seated.

2. Press front bearing cone on pinion shaft and place in housing. Install rear bearing cone, pinion flange and nut. Torque nut to 15 to 25 inch pounds. Spin gear to seat bearings.

3. Place differential assembly in position in carrier housing. Do not install caps.

4. Check dimension between face of pinion gear and O. D. surface of differential case. The proper dimension is .171" ± .002" for a pinion etched .000. If pinion face is etched .004 proper dimension would be .175", and the difference between the feeler gauge reading and .175" would determine the amount of shims needed to set the pinion properly. Shim pack should be compressed while measuring with micrometer.

5. Remove pinion shaft, remove front bearing cone from shaft and install shim pack between cone and pinion gear.

6. Reassemble pinion shaft, this time installing spacer, rear shims, oil seal and nut. Torque nut to 15 to 25 inch lbs.

7. Use feeler gauge to recheck dimension. Should be .171" ± .002".

8. Install cotter pin in flange nut.

E. INSTALLATION

To install the differential assembly in carrier, proceed as follows:

1. Place differential in carrier, engaging ring with pinion.

2. Install differential bearing cups and adjusting nuts, and caps, but do not tighten.

> CAUTION: Make sure caps are reinstalled as marked at time of disassembly.

3. Coat ring gear with Prussian Blue or white lead to obtain tooth pattern.

4. Adjust the ring gear laterally for a backlash adjustment of .005" to .010" (backlash etched on gear), by means of the differential side bearing adjusting nuts. To increase backlash, loosen adjusting nut nearest to ring gear and tighten opposite nut. To decrease backlash, reverse the operation. Differential side bearings must not be set any tighter than that which will produce a maximum pull of 3 to 5 lbs. on a string wrapped around the differential case.

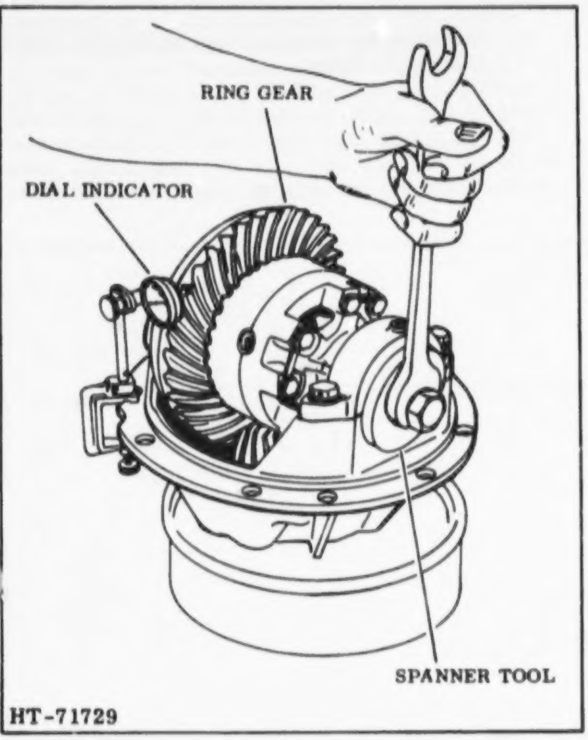


Figure 17. Adjusting Backlash

5. With the drive pinion properly installed and adjusted, rotate the pinion and hold back on the ring gear to create the effect of a load. After several rotations of the drive pinion, inspect the teeth of the pinion where the paint has been removed by gear contact. Compare the tooth bearing (area where paint was removed), with Figure 18. The tooth bearing should start at a point about 1/32 to 1/16 inch from the top of the tooth and continue downward to a point about 1/32 to 1/16 inch from the bottom of the tooth.

NOTE: Do not be concerned with the amount of paint removed from the front toward the rear of the tooth. The amount of paint removed is determined by the amount of load applied while rotating the drive pinion and ring gear. The tooth bearing should always be more toward the toe end, or a toe bearing.

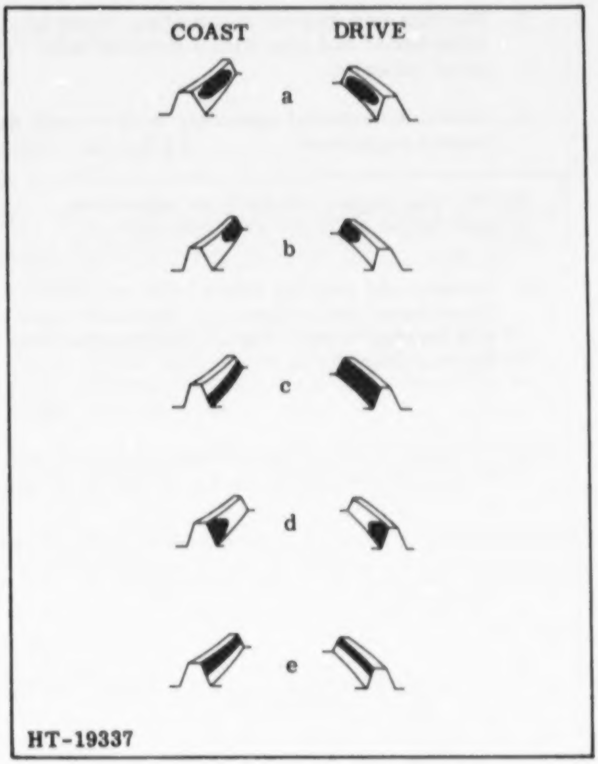


Figure 18. Differential Tooth Pattern

Explanation of Figure 18

a. Correct adjustment.

b. Heavy contact on toe of tooth. To correct, move ring gear away from pinion. Move pinion towards ring gear to again secure correct backlash.

c. Bearing too low. Heavy contact on flank of tooth. To correct, move pinion away from ring gear until contact comes to full working depth of gear tooth without bearing contact at flank. Move ring gear towards pinion to secure proper backlash.

d. Heavy contact at heel of tooth. To correct, move ring gear towards pinion. Move pinion away from gear to obtain correct backlash.

e. Shows heavy contact on tooth face. Move pinion towards gear until contact covers flank of tooth without breaking contact at face. Move gear away from pinion to secure correct backlash.

6. After proper backlash and tooth pattern are obtained, fully tighten capscrews holding bearing caps in place and wire in position.

7. Install adjusting nut lock and align with hole in adjusting nut. Secure to cap with capscrew and lockwasher.

8. Position new gasket on mounting flange of differential and coat with a suitable leak proof adhesive.

9. Install differential assembly in drive unit and install capscrews.

NOTE: Use copper washers on capscrews located below oil level of differential.

10. Connect the parking brake cable at brake drum lever and connect the hydraulic lines and leakage return line if disconnected during disassembly.

11. Replace the drain plug in bottom of differential housing assembly and fill differential with proper S.A.E. oil to recommended capacity.

12. Replace U-Joint and drive shaft coupling; Refer to U-JOINTS, INSTALLATION.

13. Install jackshafts; refer to JACKSHAFT INSTALLATION.

14. Install drive wheels; refer to DRIVE WHEEL INSTALLATION.

TOPIC 1. DRIVE WHEEL BRAKES

A. DESCRIPTION

The hydraulic brake system consists of 'semi-floating,' self-centering brake shoes especially designed for lift truck application. The system uses a mechanically activated hydraulic master cylinder which transmits a controlled braking pressure to the wheel cylinders located between the brake shoes of each drive wheel. The double ended wheel cylinders have links extending from each side of the cylinder which transmit the movement from the wheel cylinders to the brake shoes. The tops of the brake shoes move freely in a brake wear plate while the bottoms of the shoes transfer movement from the hydraulic wheel cylinders. (See Figure 1.)

No manual adjustment of the brake shoes is required as the system incorporates self adjusting brakes through use of a friction operated link assembly in each wheel.

The first requisite for safe, sure hydraulic braking is the use of a high quality brake fluid. The

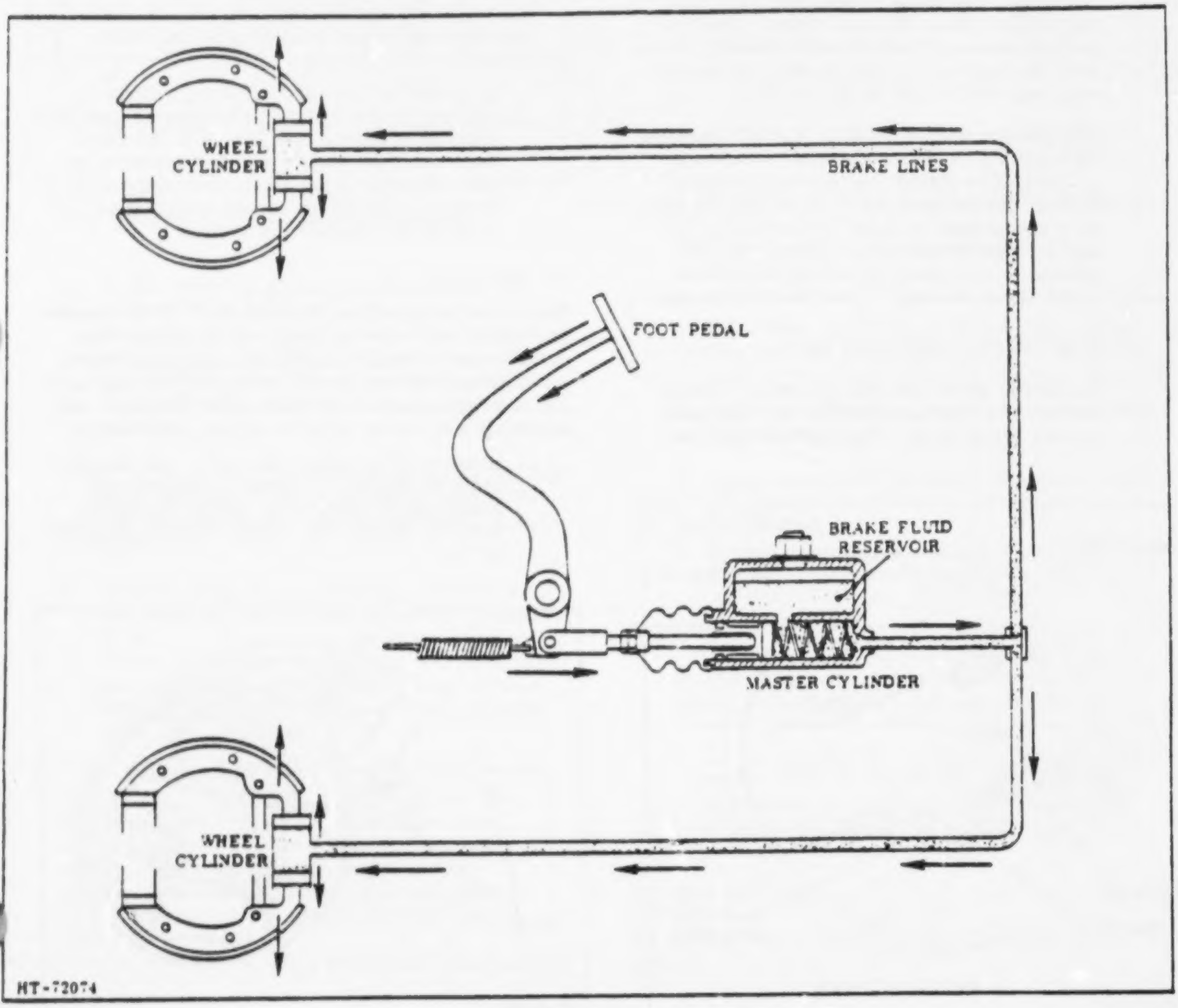


Figure 1. Hydraulic Brake System

hydraulic brake system requires a "solid column of fluid" and the fluid should possess essential protective properties which safeguard the system.

> CAUTION: Because of the importance of the fluid used in the brake hydraulic system, use only premium quality, heavy duty brake fluid with an extreme heat-cold range that conforms to SAE specification 70-R1.

1. Operation of Wheel Cylinders and Brake Shoes

   Hydraulic fluid entering the wheel cylinders from the master cylinder forces pistons to move individually and in opposed directions. This piston travel expands the brake shoes. As the pressure increases, the piston cup lips are forced more tightly against the cylinder wall, effecting a positive fluid seal, neglecting minor friction losses. The controlled actuating force is equal to and varies with the hydraulic pressure exerted against each square inch of the piston face.

   The pistons are returned to an "off" position by the force of the brake shoe retracting springs. The piston cup lips are pressed against the cylinder walls by natural resiliency and system residual pressure to seal against fluid or air leaks. The hydraulic pistons of the wheel cylinders follow the brake shoes as they expand into the drums.

2. Brake Shoes - Self-Adjusting

   The brake shoes are self-adjusting through the use of a friction operated self-adjuster in each drive wheel. The friction between the two slide assemblies of the self adjuster is great enough to prevent the brake shoe springs from fully retracting the self-adjuster, but not great enough to prevent the hydraulic pressure from expanding it. The self-adjuster assembly is mounted to the brake shoes with roll pins. The roll pin holes in the brake shoes are 1/32" oversize to provide proper working clearance between the brake shoe lining and drum.

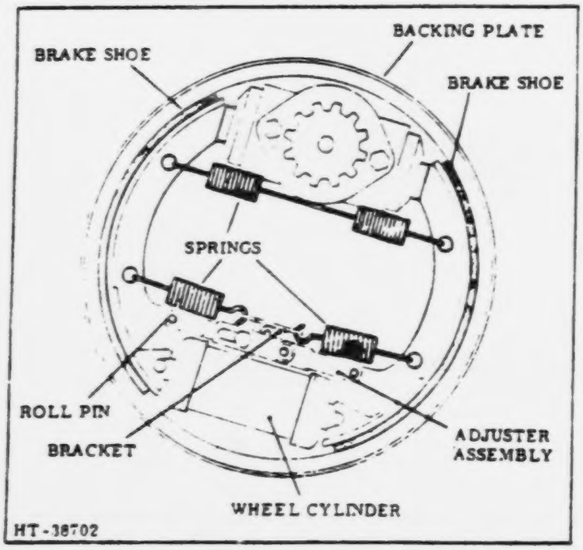


Figure 2. Self-Adjusting Brakes (Typical)

> CAUTION: Exercise care when self-adjuster is handled or installed. Do not bend the tangs of the slide assemblies in any way because the holes for the roll pins must be parallel with each other. If the holes are not parallel, the roll pins will lie at a slight angle through the mounting holes in the brake shoes. Improper alignment of the roll pins could lead to improper brake shoe retraction due to lack of proper roll pin clearance in the brake shoe holes. This in turn could create brake shoe drag on the drum.

   In order for the self-adjusting brakes to operate properly, the self adjuster assembly must be properly torqued. If it becomes necessary to remove and disassemble the self-adjuster in the field, then it must be carefully reassembled and installed as outlined in the installation section.

B. REMOVAL

Before removing drive wheels, drive truck (loaded preferred) and make an easy, rolling stop. Any pulsation or vibration on the foot pedal indicates out-of-round drums. In order to perform any service on components of the drive wheel brakes, disassemble according to the following instructions.

1. Remove drive wheel assembly and components to expose the wheel cylinders and brake shoes (Figure 3). (Refer to DRIVE WHEEL REMOVAL, MAINTENANCE MANUAL.)

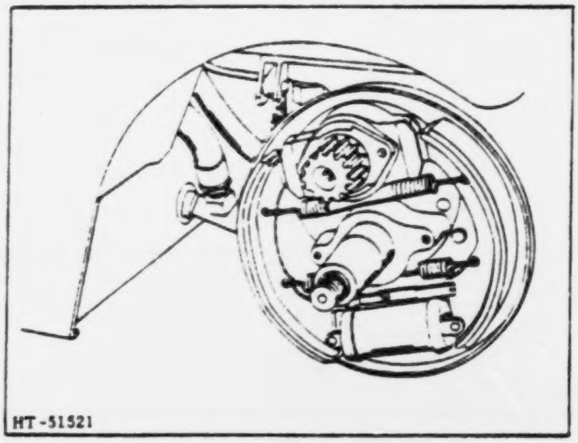


Figure 3. Dust Shield Removed

C. BRAKE DRUM INSPECTION

1. On out-of-round drums, gauge diameter or radius at points 45° apart around inside circumference of drum. Drum should be resurfaced if measurement differences are greater than .010" on diameter, or .005" on the radius.

2. If worn lining face is tapered toward one side, or worn more on the sides than at the centers, drum may be bell mouthed or barrel shaped.

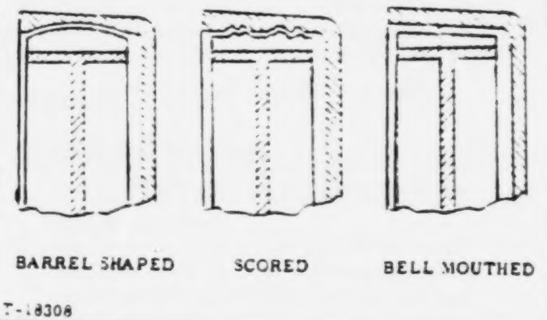


Figure 4. Improper Lining Wear

3. Check drum surfaces as indicated by wear pattern. Examine for scoring and heat checking. If not scored over .010", lining will wear in and seat after some use. Heat checked or scored drum should be replaced or resurfaced, depending upon extent of damage.

4. If drum does not require resurfacing, polish with fine emery cloth to remove discolorations and old lining residue adhering to surface.

5. If drum requires resurfacing, always resurface both drums to equal diameter. Finish grind or hone drums to remove cutting tool marks, otherwise linings will wear rapidly and brake shoes will "runout" when brakes are applied and will release with a clicking noise.

CAUTION: Never use a drum machined to a diameter greater than .050" original size. Thin drums are subject to excessive heat expansion and flexing, causing fade and spongy pedal. They also could break under strain of severe use. (Refer to following chart.)

Original I.D. of Brake Drum	Maximum Machined I.D.
11.000" to 11.010"	11.060"
13.125" to 13.135"	13.185"
13.135" to 13.145"	13.195"
14.250" to 14.260"	14.310"

D. BRAKE SHOES AND LINING

The brake shoes employ bonded lining. When lining replacement becomes necessary, it is recommended that the brake shoes are replaced. Replace brake shoes when any of the following have occurred:

1. Drums are resurfaced.
2. Lining is worn to shoe table.
3. Grease or hydraulic fluid soaked linings, causing brakes to grab or pull to one side.
4. If difficulty in stopping is traced to linings.
5. Fade is traced to severely charred or burned linings.

NOTE: Minor charring is sometimes remedied by buffing with sandpaper or grinding.

6. Lining is scored too deeply to be reworked by grinding.
7. Brake shoe table is worn, twisted or out-of-round.
8. Shoe is cracked. For brake shoe removal, refer to following Paragraph E, DISASSEMBLY.

CAUTION: Whenever handling brake shoes, be careful not to get grease or dirt on brake linings as serious damage may result.

Dirt or grease on brake linings (not grease soaked) may be remedied by buffing with sandpaper or grinding. Clean shoes with compressed air and dry cloth to prevent damaging shoes or linings.

E. DISASSEMBLY

To disassemble brake assembly proceed as follows:

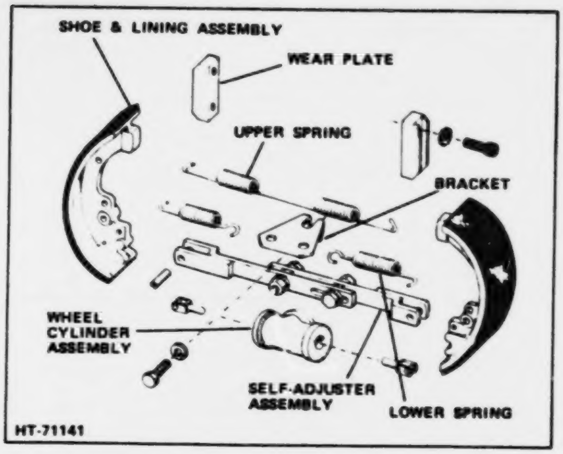

SHOE & LINING ASSEMBLY
WEAR PLATE
UPPER SPRING
BRACKET
WHEEL CYLINDER ASSEMBLY
SELF-ADJUSTER ASSEMBLY
LOWER SPRING
HT-71141

Figure 5. Self-Adjusting Brakes (Exploded View)

1. Remove upper and lower shoe return springs.

2. Remove brake shoes and adjuster link as an assembly

3. Drive out roll pins which attach adjuster link to brake shoes. Compress adjuster link by placing one end on a solid surface and tapping other end with a wooden mallet or a block of wood until fully compressed.

F. INSTALLATION

To install shoes with new lining, proceed as follows:

1. If self-adjusted link is inadvertently disassembled, it must be reassembled exactly as originally constructed (Figure 6). Torque capscrews to 14 - 16 inch lbs., and lock nuts to 29 inch lbs. Slip resistance must be from 250 to 300 lbs. and link should be fully retracted when assembly is completed.

2. Attach adjuster link to brake shoes with roll pins.

3. Make certain backing plate is secured tightly to axle, also that it is not sprung or damaged.

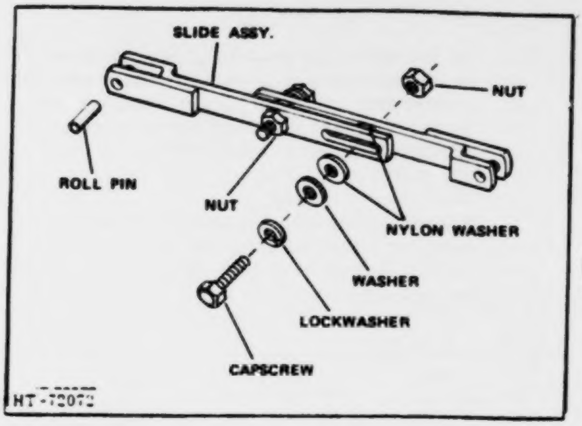

SLIDE ASSY.
NUT
ROLL PIN
NUT
NYLON WASHER
WASHER
LOCKWASHER
CAPSCREW
HT-72072

Figure 6. Brake Self-Adjuster

4. Clean inside of backing plate, brake drum and other parts to be assembled.

5. Check wheel cylinders for leakage, even if cylinder appears to be in good condition. The best practice is to overhaul wheel cylinders when new brake shoes are installed.

6. Place shoe and link assembly in place and install springs. Install wheel assembly in direct reversal of removal procedure. While turning wheel SIX times in each direction, torque retaining nut to a maximum of 50 ft. lbs., then back nut off 30° minimum -60° maximum to allow cotter pin installation.

7. The first time brake pedal is depressed after installing new shoes automatically sets the adjustment.

Drive wheels should be removed periodically until approximate wear period for brake lining can be determined. No further adjustment is required after shoes are replaced.

CAUTION: NEVER apply pressure to brake pedal until drive wheel brakes and wheels are completely assembled

TOPIC 2. MASTER CYLINDER

A. DESCRIPTION

Brake cylinder and fluid reservoir are combined in one casting and are joined by intake and by-pass ports located in the cylinder wall. Internal parts are removed or installed at push rod end. Stop plate holding internal parts is retained by a lock-wire clipped into cylinder bore. Cylinder piston is operated through a push rod connected to the brake pedal. The push rod and cylinder opening is enclosed with a rubber boot.

It is considered impractical to thoroughly clean the cylinder and fluid reservoir mounted in the truck. For this reason follow instructions below.

B. REMOVAL

1. Remove floor plate.
2. Disconnect brake hydraulic line attached to master cylinder.
3. Remove clevis pin securing push rod to brake pedal assembly.
4. Remove capscrews holding master cylinder to inside of frame and remove cylinder.
5. Secure cylinder in vise exercising care so as not to distort cylinder or crack the casting.
6. Remove boot and push rod.
7. Pry out lock ring holding piston assembly in position.

CAUTION: When lock ring is removed, entire piston assembly will spring out if not held in place.

8. Carefully remove copper washer, piston, rubber, spring and seat.
9. Working from other end of cylinder, remove outlet fitting bolt, copper washers, and brake line fitting.
10. Remove filler cap and all other washers and fittings.
11. Clean hydraulic parts and keep clean so that there is no trace of dirt, metal filings, sludge, or other deposits when unit is ready for assembly. Do not use cotton waste. Use lint-free cloth in cleaning. Internal parts must be cleaned in clean denatured alcohol or hydraulic brake fluid.

CAUTION: Mineral base cleaning solvents (gasoline, kerosene, distillates, carbon tetrachloride, acetone, paint thinners, etc.) deteriorate rubber parts, causing them to become soft, tacky and swollen.

Cylinder castings may be cleaned with usual cleaning methods but must be finish cleaned with denatured alcohol or brake fluid to remove all traces of solvent.

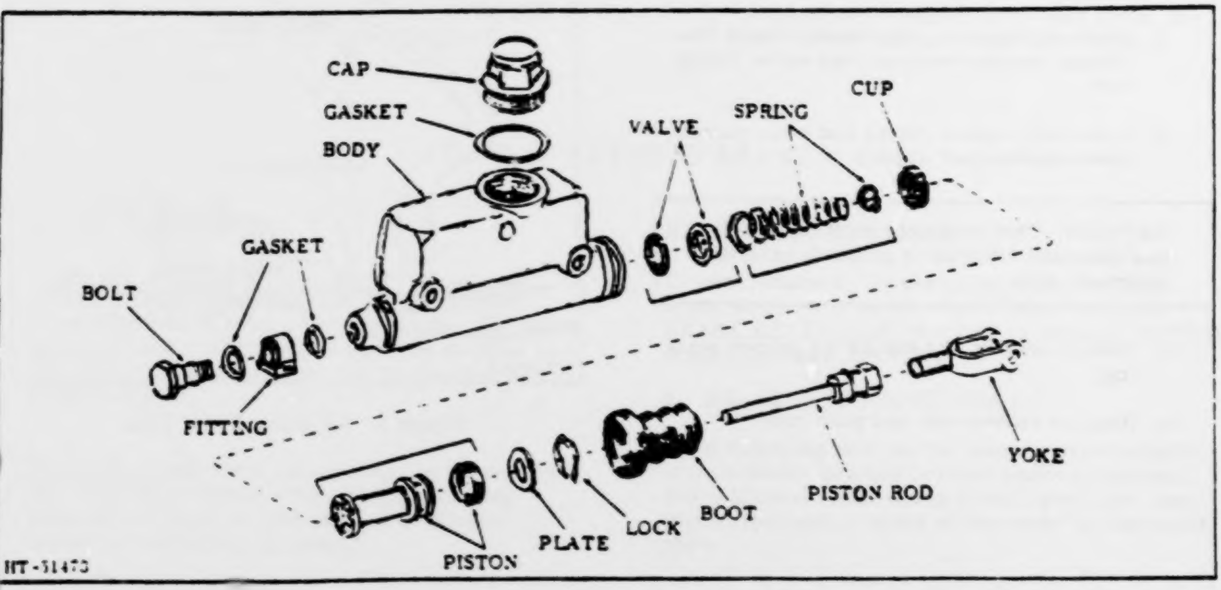


Figure 7. Master Cylinder Assembly

12. Inspect cylinder bore. Deep blemishes require reboring to resurface the cylinder wall. Pressure marks and discoloration may be polished out with crocus cloth. (Do not use emery cloth or sandpaper.) Make certain intake and bypass ports are open. Bypass port may be probed with soft iron wire. Follow the honing equipment manufacturers recommendations for honing. Care must be exercised not to go beyond tolerances for cylinder size. A cylinder honed oversize must be discarded.

13. Before assembly, inspect parts for corrosion, scratched or pitted piston bearing surfaces, rubber deterioration (swelling, softening, tackiness, etc.) and spring action. If cylinder has been honed, replace all parts contained in repair kit. Replace all other parts which appear worn or damaged.

14. Lubricate parts and cylinder bore with clean brake fluid and assemble in direct opposite sequence of disassembly procedure.

CAUTION: Make certain lock ring is firmly seated in groove provided in end of cylinder.

Largest end of piston spring and pressure valve must be toward outlet end of cylinder.

C. INSTALLATION

1. Secure the cylinder body in a vise, exercising care so as not to distort the cylinder unit or crack casting.
2. Replace filler cap, washers and fittings previously removed.
3. Refer to Figure 6, and replace brake line fitting, copper washers, and outlet fitting bolt.
4. Carefully replace spring and seat, rubber, piston and copper washer.

CAUTION: This assembly must be held in position until lockring is properly inserted to retain parts.

5. Insert lockring and ensure its proper seating.
6. Replace rubber boot and push rod.
7. Ensure that cylinder is completely reassembled prior to installing.
8. Replace master cylinder in its relative mounting location and install securing capscrews.
9. Attach brake pedal push rod to cylinder and secure with clevis pin previously removed.
10. Connect brake hydraulic line to cylinder.
11. Refer to LUBRICATION CHART and fill cylinder with proper high grade hydraulic brake fluid.
12. Bleed brake system as outlined under appropriate heading, this Section.
13. Replace floor and toe plate.

D. PEDAL LINKAGE

If pedal linkage does not provide proper clearance or lash between master cylinder piston and linkage with brakes released, piston cannot return to full off position. Brakes will drag after several applications if bypass port is blocked. Refer to Figure 8 and proceed as follows:

1. Loosen locknut at master cylinder.
2. Adjust linkage to provide 1/2" of free play measured at brake pedal. More free play will reduce usable stroke of master cylinder piston.
3. Tighten locknut.

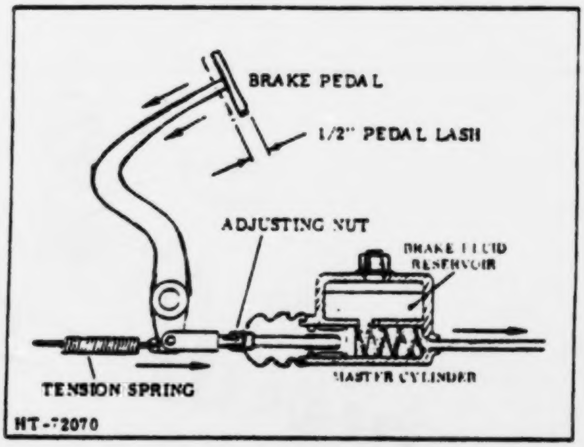


Figure 8. Adjusting Pedal Lash

TOPIC 3. WHEEL CYLINDERS

A. DESCRIPTION

The hydraulic wheel cylinder houses two opposed pistons which actuate the opposed brake shoes. (See Figure 9.) The pistons, rubber cups, and springs are held in place, in the cylinders, by the brake shoe mechanical pressure. The opened ends of the cylinders are protected with rubber boots. Since the wheel cylinders of a hydraulic brake system are a very important part of the whole system, it is necessary that the following reconditioning instructions are carefully followed:

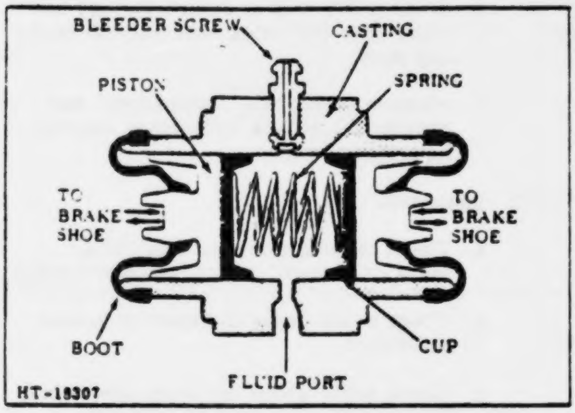


Figure 9. Wheel Cylinder

B. SERVICE

1. Remove wheel assembly, bearings and brake shoes. (Refer to DRIVE UNIT REMOVAL, MAINTENANCE MANUAL.)
2. Remove hydraulic line attached to wheel cylinder. Remove wheel cylinder mounting capscrews and remove cylinder.
3. Pull boots from cylinder and push out internal parts. Low pressure air at fluid inlet can be used to remove cylinder components.
4. Clean all parts thoroughly and keep them clean until unit is ready for assembly. Use lint-free cloth for cleaning.

CAUTION: Wash parts thoroughly in denatured alcohol or clean brake fluid. Never use gasoline, kerosene, paint thinner or other mineral base solvents as they will damage rubber components.

5. Thoroughly inspect all parts for wear, corrosion or other conditions which might impair cylinder action.
6. If wheel cylinder is to be honed, follow specific instructions furnished with honing equipment, as these instructions may vary.

NOTE: Cylinder honed oversize will leak and must be discarded.

7. Lubricate all parts and cylinder walls with clean brake fluid. Insert each piston in its respective end. Never try to push piston through length of cylinder. After cylinder is assembled, install cylinder boots. Be sure they are properly located in grooves provided.
8. Reassemble cylinder to backing plate. Install brake unit and wheel assembly.

TOPIC 4. PARKING BRAKE

A. DESCRIPTION

A dual shoe mechanical brake, mounted at the drive shaft, is used as a parking brake. The brake shoes are actuated through a cable by an adjustable over-center type lever mounted on the left hand cowl panel.

The brake mechanism requires no lubrication except at time of reassembly. Brake actuating mechanism, such as hand lever and linkage, should be lubricated periodically.

B. HAND BRAKE ADJUSTMENT

To compensate for brake lining wear the hand brake lever must be adjusted. Refer to HAND BRAKE LEVER ADJUSTMENT in BRAKE SYSTEM MAINTENANCE MANUAL.

C. BRAKE SHOE ADJUSTMENT

If the adjusting knob on the parking brake handle will no longer provide correct brake adjustment and sufficient brake lining is still available, further adjustment is made at the lower brake-cable yoke.

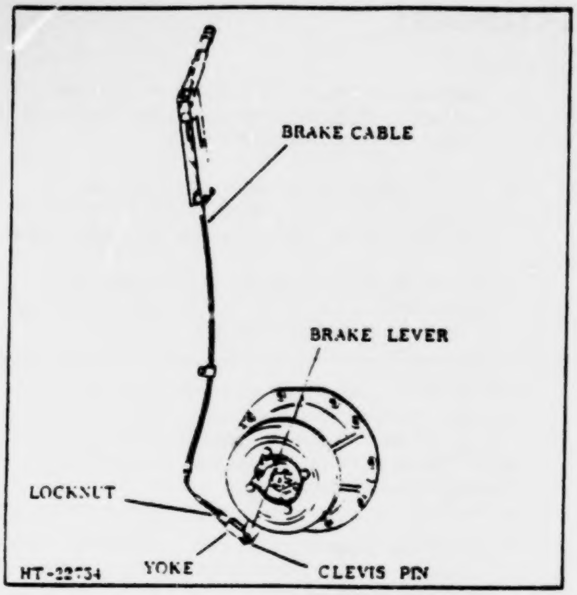


Figure 10. Adjustment at Brake Shoes

1. Remove adjusting knob lockscrew from parking brake handle and back off knob four or five turns. Brake must be in OFF position during adjustment.
2. Remove floor plate.
3. Remove clevis pin from yoke and loosen yoke locknut.
4. Turn yoke in clockwise direction to shorten length of cable. Generally three or four turns will be sufficient.
5. Install yoke on brake lever and check adjustment by engaging hand brake handle. If necessary, make further adjustment to yoke to make certain brake shoes do not drag when disengaged.
6. After satisfactory adjustment is made, tighten yoke locknut; install cotter pin in yoke clevis pin. Install locking screw in adjusting knob of parking brake handle.

D. BRAKE SHOE REPLACEMENT

When excessive adjustment is needed on parking brake linkage, or when parking brake becomes ineffective in holding truck securely, the brake shoes should be checked and, if necessary, replaced. To check or replace parking brake shoes the following procedure is recommended:

1. Removal and Disassembly
   - a. Place blocks in front and behind one of the lift truck wheels.
   - b. Remove toe and floor plates.
   - c. Remove cotter pin and clevis pin securing brake cable to brake lever.
   - d. Remove universal joint.
   - e. Remove lockwire, capscrews, and lockwashers and remove brake drum from differential pinion flange.
   - f. Remove cotter pin and nut, then remove hub from pinion shaft.
   - g. Remove brake lever and rollers from backing plate.
   - h. Remove brake shoe return springs and slide shoe and lining assembly off backing plate.
   - i. Remove capscrews, lockwasher, and backing plate from differential carrier housing assembly.
2. Inspection
   - a. Check backing plate for distortion, loose or sheared rivets, and worn pawls.
   - b. Check brake lining for wear or grease saturation.
   - c. Check brake shoes for worn pawl holes, lever contact areas, or wear pads.
   - d. Check brake drum for cracks, scoring, or other damage. Replace damaged parts.
   - e. Always replace shoe return springs during reassembly.
3. Reassembly and Installation

   Reassembly and installation is the reverse of removal and disassembly with the exception of lightly coating the wear pads and pawls on the backing plate, the lever, and the brake shoe wear points with lubricant. Avoid excessive lubricant as grease soaked linings are dangerous.

   - a. Replace backing plate, lockwashers and capscrews on differential carrier housing.
   - b. Slide shoe and lining assembly on backing plate and replace brake shoe return springs.
   - c. Install brake rollers and brake lever on backing plate.
   - d. Replace hub on pinion shaft and install nut and cotter pin.

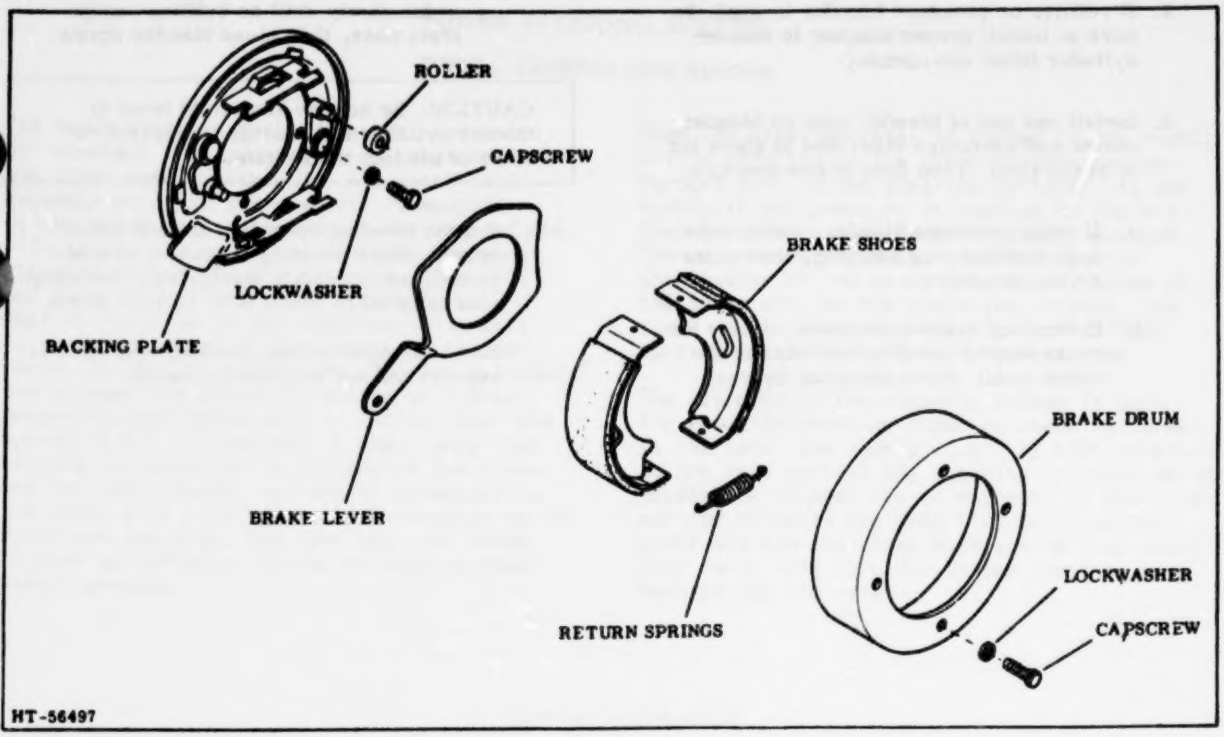


Figure 11. Brake Shoe Components

e. Replace brake drum on differential pinion shaft, then install lockwashers, capscrews and lockwire.

f. Install universal joint.

h. Replace clevis pin and cotter pin which secure parking brake cable to brake lever.

h. Ensure that parking brake unit has been completely reassembled, then replace floor and toe plates.

TOPIC 5. BLEEDING THE BRAKE SYSTEM

A. REASON FOR BLEEDING BRAKES

Brakes must be bled after any of the following occurences:

1. Brake system is drained and refilled with new fluid.
2. Some part of the system has been disconnected.
3. Neglect in maintaining proper fluid level in master cylinder has allowed air to enter system.
4. Air leakage past master cylinder secondary cup or wheel cylinder cups due to wear, or to a vacuum maintained within the cylinder by a plugged filler cap vent.
5. Overheating of brakes caused under severe operating conditions could cause gassing or boiling of fluid, thereby creating a vapor lock and giving a spongy pedal.

B. BLEEDING SEQUENCE

1. Fill master cylinder to proper level (3/8" to 1/2" from reservoir top).

CAUTION: Due to importance of fluid used in brake system, use only premium quality, heavy duty brake fluid with an extreme heat-cold range that conforms to SAE specification J1703C.

2. If refiller or pressure bleeder is used, be sure to install proper adaptor in master cylinder filler cap opening.

3. Install one end of bleeder hose on bleeder screw and submerge other end in glass jar of brake fluid. Then open screw one turn.

   a. If using pressure bleeder, watch hose until bubbles stop emitting, then close screw securely.

   b. If bleeding system manually, it may be necessary to use 10-15 strokes of the brake pedal. Have assistant depress pedal slowly until no bubbles escape from hose, then close bleeder screw.

CAUTION: Be sure to keep fluid level in master cylinder high enough to prevent re-entry of air into the system.

4. Repeat bleeding operation at each bleed screw. After bleeding operation is completed, make certain master cylinder reservoir is filled to within 3/8" to 1/2" of top.

   Fluid salvaged during bleeding operation is aerated and not suitable for reuse.

POWER STEERING SYSTEM

TOPIC 1. GENERAL DESCRIPTION

The power steering system converts hydraulic oil movement into mechanical movement to turn the steer wheels with ease. The steer axle assembly with the steer wheels is mounted to the frame and is located at the rear of the lift truck. The main components in the power steering system are the steering valve unit, and steering cylinder. The hydraulic oil that is supplied to the steering valve unit is directed to one of the steering cylinder ports. As the oil enters the steering cylinder, the plunger rod begins to extend or retract, depending upon which port in the cylinder the hydraulic oil is directed. A short drag link or yoke is installed on the end of the steering cylinder plunger rod and is connected to the steer axle pivot arm. Also connected to the pivot arm are right and left tie rods which in turn are attached to the respective steer wheel spindles.

When the steering wheel is turned to the right, oil is directed by the steering unit to the forward port in the steering cylinder. As the hydraulic oil pressure is applied to the piston, the piston and plunger rod move outward. The plunger rod by means of the drag link then pushes on the pivot arm which rotates on the pivot pin. As the pivot arm rotates, the steer wheels move into position for a right turn due to the movement of the tie rods..

The movement of the steering system is just the opposite when the steering wheel is turned to the left. The hydraulic oil is then directed to the rear port in the steering cylinder which causes the plunger rod to retract. As the plunger rod retracts the drag link pulls on the pivot arm and the steer wheels move into position for a left turn due to the opposite movement of the tie rods.

TOPIC 2. STEER AXLE

A. REMOVAL

1. Remove the floor plate and toe plate.
2. Attach a suitable hoist to the rear of the truck and raise the truck until the drag link and steer axle are accessible. Block the front wheels, and place blocks under both sides of the frame to support the rear of the vehicle. Blocks and chain must not interfere with removal of steer axle.
3. Remove steer wheels and wheel bearings.
4. Disconnect drag link from pivot arm by loosening the adjusting plug at the end of the drag link until the link can be lifted from the ball stud on the pivot arm.
5. Place a jack under the steer axle assembly and raise jack enough to take the stress from the axle mounting capscrews and nuts.
6. Type III Steer Axle Only:

   Loosen jam nut and back away adjusting screw in frame just ahead of the steer axle's front pivot pin. (Adjusting screw is used to take up end play between steer axle's front pivot pin and the frame).
7. Remove nuts and/or lockwashers, and capscrews that secure the axle to the frame
8. Lower the jack with the axle on it, and withdraw the axle from under the vehicle.

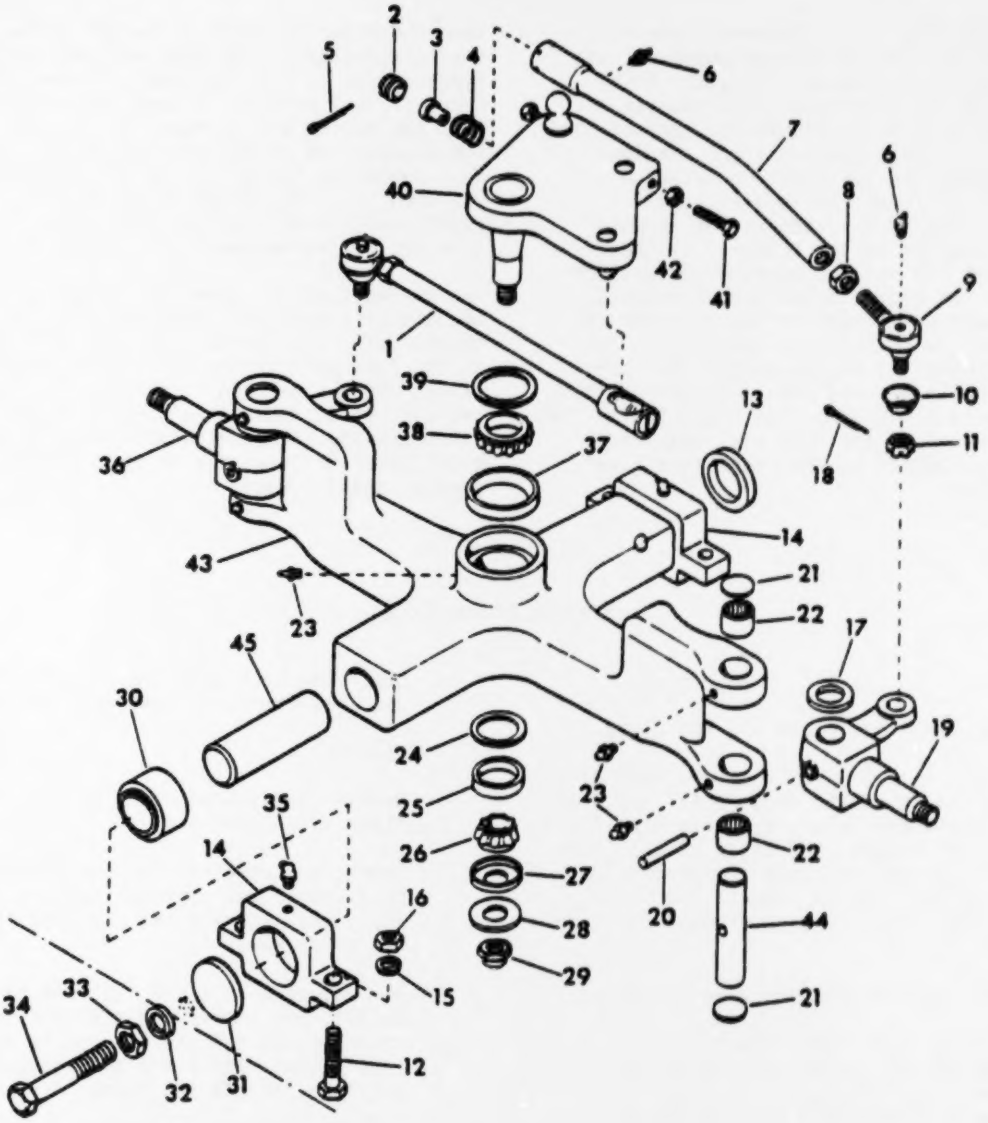
B. DISASSEMBLY

1. Remove the axle mounting housing from steer axle pivot pin.
2. Remove cotter pins, adjusting plugs, ball seats, and springs from the tie rods, and separate the tie rods from the pivot arm.
3. Remove cotter pin and nut from ball socket, and remove the tie rods from the spindles. Loosen the nut on the ball socket, and remove the ball socket and nut from the tie rod tubes.
4. Remove expansion plugs from king pin bores in the axle assembly. Drive roll pins from king pins and spindles, and remove the king pins, needle bearings and spindles from the axle.
5. Type I Steer Axle:

   Remove wedge bolt (Fig 3), and washer. Remove pivot pin, and spacers, and lift pivot arm from axle assembly. Remove bushings from axle.

   Type II and III Steer Axles:

   Use a punch to straighten out stake indentation in end of nut. Remove nut, washer, seal and lower cone; lift pivot


2
3
4
5
6
7
6
40
8
42
41
9
1
39
38
37
36
13
10
18
11
14
43
21
23
22
45
17
30
24
19
25
35
23
26
14
27
22
16
28
20
44
29
15
21
34
33
32
31
12

1. TIE ROD
2. ADJUSTING PLUG
3. BALL SEAT
4. SPRING
5. COTTER PIN
6. GREASE FITTING
7. TIE ROD TUBE
8. NUT
9. BALL SOCKET
10. CUP
11. NUT
12. CAPSCREW
13. SPACER
14. AXLE MOUNT HOUSING
15. LOCKWASHER
16. NUT
17. THRUST BEARING
18. COTTER PIN
19. LEFT SPINDLE
20. ROLL PIN
21. EXPANSION PLUG
22. NEEDLE BEARING
23. GREASE FITTING
24. RETAINING RING
25. LOWER CUP
26. LOWER CONE
27. SEAL
28. WASHER
29. NUT
30. HOUSING BUSHING
31. SPACER
32. LOCKWASHER
33. JAM NUT
34. ADJUSTING SCREW
35. GREASE FITTING
36. RIGHT SPINDLE
37. UPPER CUP
38. UPPER CONE
39. SEAL
40. PIVOT ARM
41. CAPSCREW
42. NUT
43. STEER AXLE HOUSING
44. KING PIN
45. PIVOT PIN

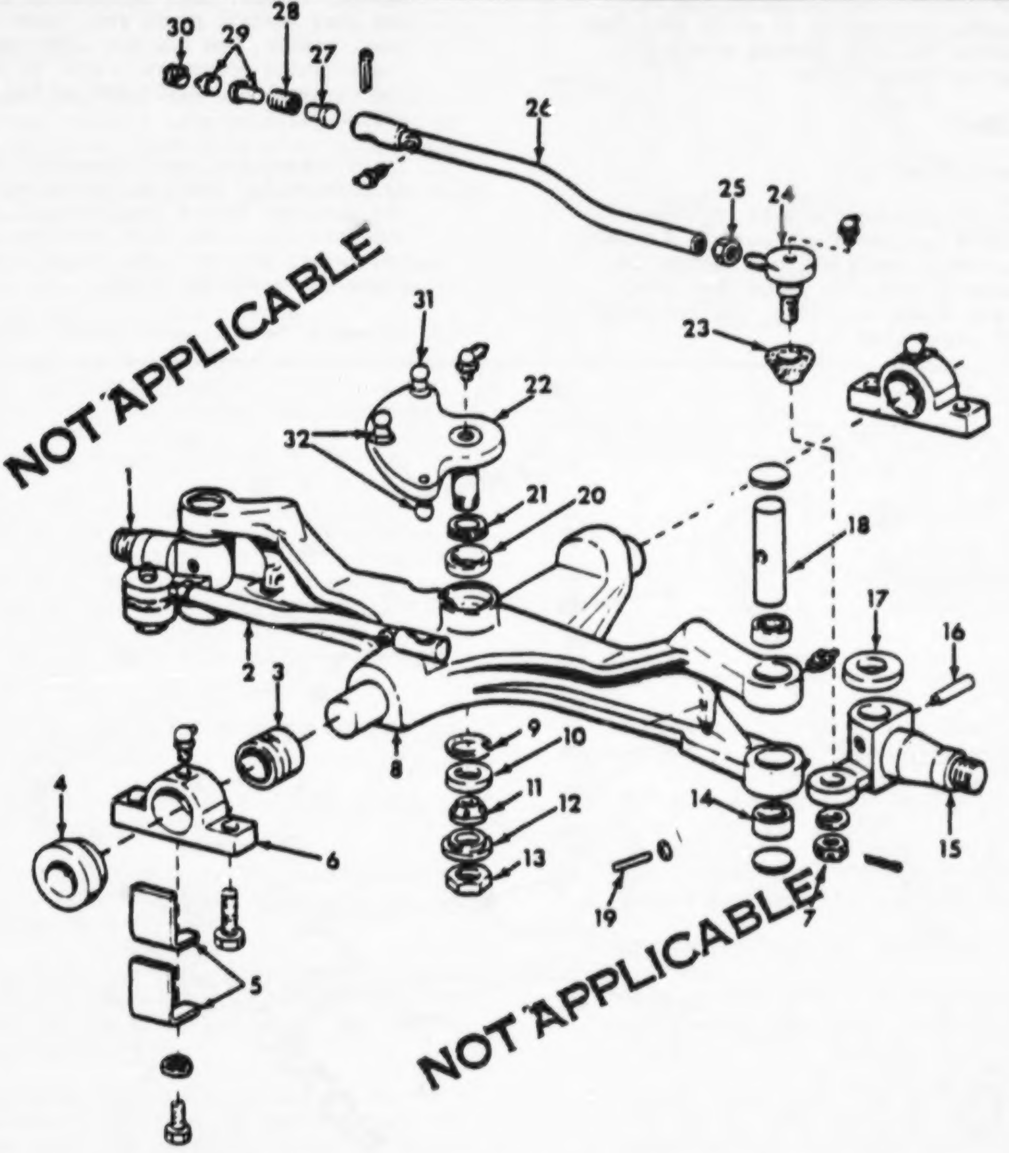
MAT-74038

Figure 1. Steer Axle Assembly (Type III) (with Adjusting Screw)

arm from steer axle housing and remove seal and upper cone. Use a brass drift and remove upper and lower bearing cups from steer axle housing; remove retaining ring.

C. CLEANING AND INSPECTION

1. Clean all parts with mineral spirits or other suitable solvent, and dry with compressed air.



NOT APPLICABLE

NOT APPLICABLE

1. LEFT SPINDLE
2. LEFT TIE ROD
3. BUSHING
4. SPACER
5. SHIMS
6. AXLE MOUNTING HOUSING
7. NUT
8. STEER AXLE HOUSING
9. RETAINING RING
10. LOWER CUP
11. LOWER CONE
12. WASHER
13. NUT
14. NEEDLE BEARING
15. RIGHT SPINDLE
16. ROLL PIN
17. THRUST WASHER
18. KING PIN
19. SPINDLE STOP
20. UPPER CUP
21. UPPER CONE
22. PIVOT ARM
23. COVER
24. BALL SOCKET
25. NUT
26. RIGHT TIE ROD
27. PLUG
28. SPRING
29. SEAT
30. ADJUSTING PLUG
31. BALL STUD
32. BALL STUD

AAT-74055

Figure 2. Steer Axle Assembly (Type II)
(with Welded Pivot Arm Pin and Adjusting Shims)

2. Inspect all parts for cracks, breaks, bends, other damage, and wear. Repair or replace parts as indicated by their condition.

3. Lubricate all parts except the ball sockets with an SAE 10 or 20 oil. Pack the tie rod ball sockets with high quality chassis lube.

D. REASSEMBLY

1. Type I Steer Axle:

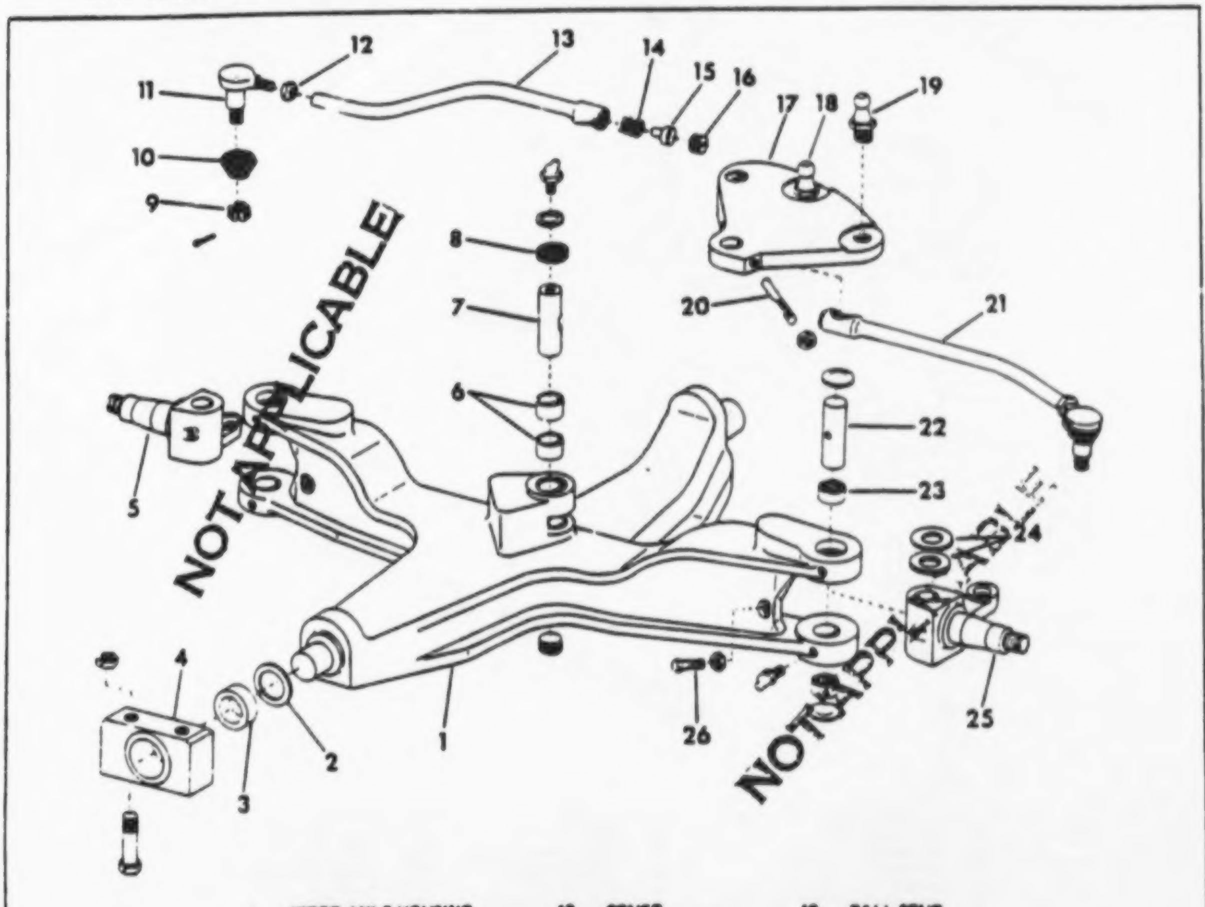
   Install bushings in axle. Position spacers and pivot arm on axle assembly and insert the pivot pin. Align the groove in pin with wedge bolt slot, insert wedge bolt (Fig. 3), and secure with washer and nut.

   Type II and III Steer Axles:

   Install retaining ring and lower bearing cup in steer axle housing; install upper bearing cup. Make certain cups are firmly seated. Install seal and cone on pivot arm pin; install pivot arm, lower cone, seal, washer, and new nut. (For proper installation procedure, refer to following Paragraph F, PIVOT ARM INSTALLATION PROCEDURE.)

2. Install king pin needle bearings in the axle assembly. Position the spindle on the axle and insert the king pin. Align the roll pin in the king pin and spindle, and insert the roll pin. Install and stake new expansion plugs.

3. Assemble the nut, ball socket, cup,



1. STEER AXLE HOUSING
2. SPACER
3. BUSHING
4. AXLE MOUNTING HOUSING
5. RIGHT SPINDLE
6. BUSHING
7. PIVOT ARM PIN
8. WASHER
9. NUT
10. COVER
11. BALL SOCKET
12. NUT
13. TIE ROD TUBE
14. SPRING
15. SEAT
16. ADJUSTING PLUG
17. PIVOT ARM
18. BALL STUD
19. BALL STUD
20. WEDGE BOLT
21. LEFT TIE ROD
22. KING PIN
23. NEEDLE BEARING
24. THRUST WASHERS
25. LEFT SPINDLE
26. SPINDLE STOP

MAT-74055

Figure 3. Steer Axle Assembly (Type I)
(with Removeable Pivot Arm Pin and Wedge Bolt)

seats, springs, plug to tie rods. Position the tie rods on the pivot arm and tighten plug until seats firmly grasp ball stud on the pivot arm. Install ball socket on spindle and secure with nut and cotter pin.

E. INSTALLATION

1. Depending upon the model of the lift truck, install axle mounting housing or housings on steer axle pivot pins. Type III steer axle requires that solid spacer is positioned between end of pivot pin and frame.

2. Position steer axle on a jack or other suitable device and raise it into position under the truck frame.

3. Install mounting capscrews, lockwashers, and nuts if applicable; tighten until snug to permit movement for adjustment.

4. Type III Steer Axle:

   Push entire steer axle against rear spacer and turn adjusting screw IN or OUT (as applicable) to take up end play between pivot pin and solid spacer. Tighten adjusting screw to a torque of 10-15 lb-ft. Tighten jam nut to a torque of 90-100 lb-ft after adjustment is completed.

5. Tighten steer axle mounting nuts or capscrews securely.

6. Thoroughly lubricate all lube points of the steering system.

7. Connect drag link to the pivot arm. Install floor plate and toe plate and fasten securely.

8. Lubricate the inner wheel bearing cone with specified grease. Use an applicator designed to force lubricant into the bearing rollers.

9. Position inner bearing cone on the spindle. Lubricate the bearing cups in the wheel and carefully install the wheel on the spindle.

10. Lubricate the outer bearing cone with the specified lubricant, using an applicator. Install the bearing cone on the spindle.

11. Install washer and retaining nut on spindle. While rotating steer wheel, tighten retaining nut to a torque of 50 lb-ft; then back off nut until loose (0 lb-ft). Rotate wheel alternately in each direction while tightening retaining nut until a torque of 25 lb-ft is obtained. Then back off nut 30° min to 60° max and install cotter pin.

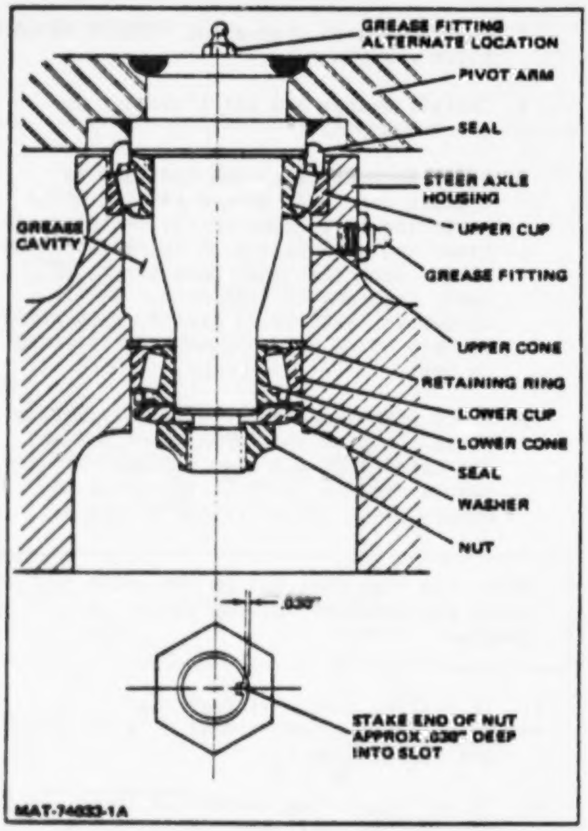


Figure 4. Pivot Arm Installation
(Type II and III Steer Axles)

12. Install hub cap and secure with capscrews and lockwashers, tightening capscrews seucrely. Lower the truck to the floor.

F. PIVOT ARM INSTALLATION PROCEDURE

1. Make certain pivot arm pin, bearing seats, and steer axle housing bore are clean.

2. Install retaining ring and lower bearing cup in steer axle housing; install upper bearing cup. Make certain cups are firmly seated.

3. Seat upper seal (Fig. 4) on pivot arm firmly. Fill seal with specified grease.

4. Pack upper cone with specified grease and press it onto pivot arm pin until it is seated against the shoulder.

5. Install pivot arm with bearing in steer axle housing.

6. Pack lower bearing cone with grease and install it on pivot arm pin.

7. Fill seal with grease and install it on pivot arm pin.

8. Install washer and start new nut on pivot arm pin.

9. Use a torque wrench and continue to tighten nut. Note torque reading while advancing lower cone to its seated position. You will notice an increase in the torque when the lower cone starts to seat. Continue to tighten nut until torque is 15-25 lb-ft greater than previously noted before lower cone started to seat.

10. Check rotational bearing torque. Rotate pivot arm back and forth several times and take rolling torque reading. It should require 15-25 lb-in torque to rotate pivot arm in either direction.

NOTE: Tie rods must not be connected to pivot arm whenever rolling torque is checked.

11. If rolling torque is less than 15 lb-in, tighten nut an additional 5 lb-ft torque and repeat Step 10.

12. If rolling torque exceeds 25 lb-in, back nut off one full turn. Strike end of pivot arm pin with a softheaded mallet to unseat bearings and repeat Steps 9 and 10.

13. After proper rolling torque is obtained, stake end of nut approximately .030" deep into slot (Fig. 4).

14. Fill cavity with specified grease until it seeps out between pivot arm and steer axle housing.

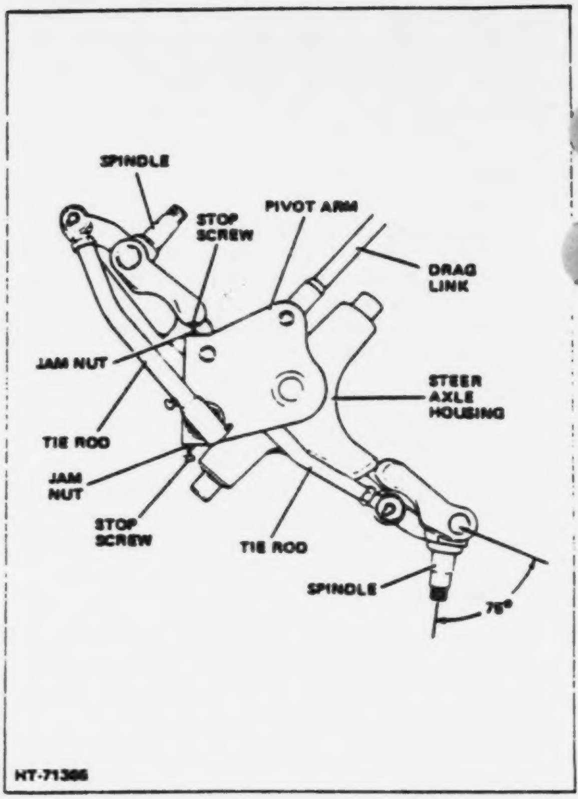


Figure 5. Pivot Arm Stop Adjustment

G. PIVOT ARM STOP ADJUSTMENT

1. Turn steer wheels first to full right turn and then to full left turn and adjust pivot arm stop screw each time.

2. Loosen jam nuts and adjust the pivot arm stops (Fig. 5) to allow 1/2" clearance between the steer wheel and steer axle housing with the wheels turned full right or full left. Stops should limit travel of wheel spindle to 75° from centerline of spindle. Tighten stop screw jam nut to a torque of 2 to 3 lb-ft.

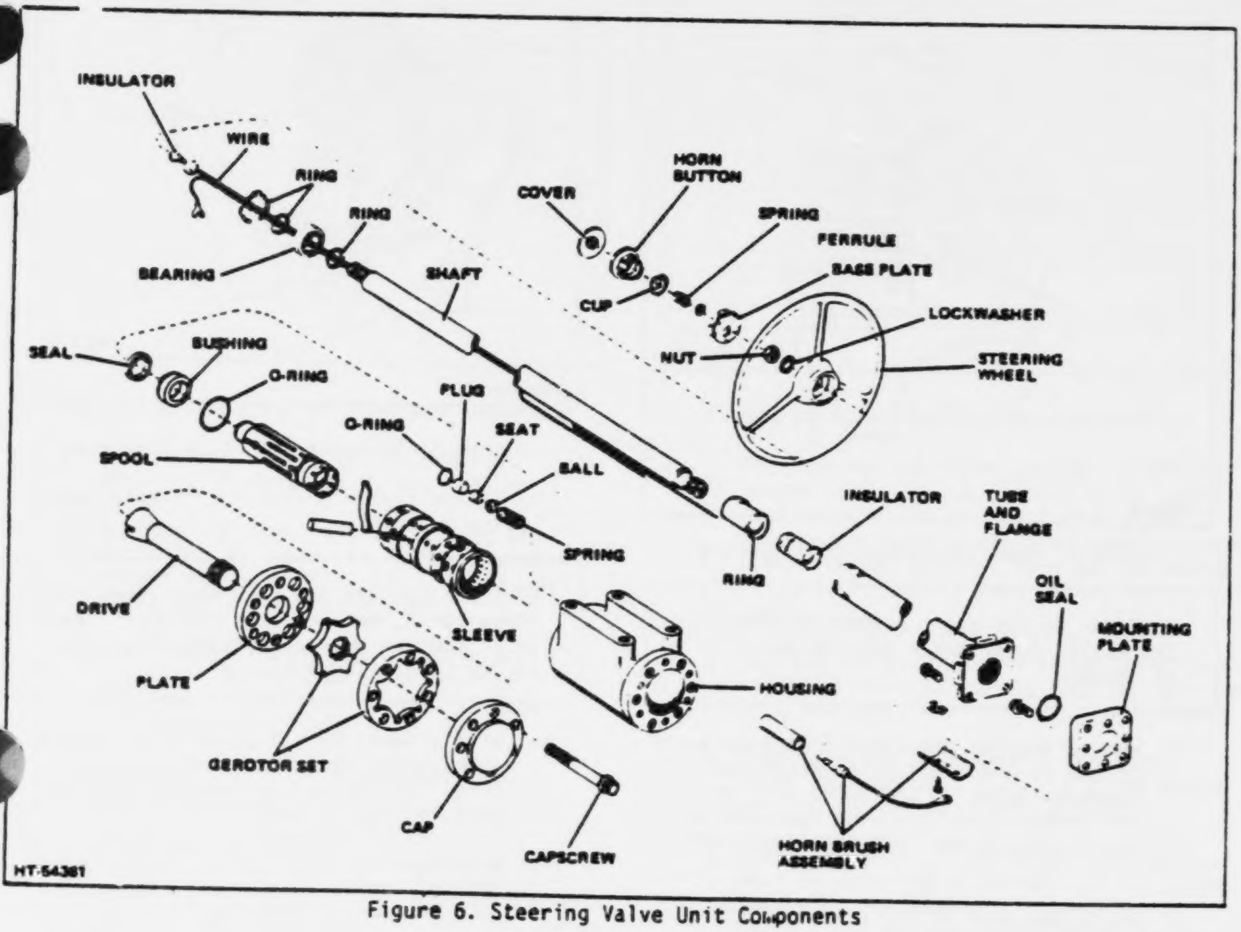

INSULATOR
WIRE
RING
RING
BEARING
SHAFT
COVER
HORN BUTTON
SPRING
FERRULE
BASE PLATE
CUP
LOCKWASHER
NUT
STEERING WHEEL
SEAL
BUSHING
O-RING
PLUG
O-RING
SEAT
BALL
SPOOL
SPRING
INSULATOR
TUBE AND FLANGE
RING
OIL SEAL
MOUNTING PLATE
DRIVE
SLEEVE
PLATE
HOUSING
GEROTOR SET
CAP
CAPSCREW
HORN BRUSH ASSEMBLY
HT-54381

Figure 6. Steering Valve Unit Components

A. REMOVAL

1. Remove the floor plate and toe plate.

2. Disconnect hydraulic hoses from steering valve unit. Cover all openings immediately to prevent entry of dirt in the hydraulic system.

3. Disconnect horn button wire at the horn.

4. Remove capscrews that secure steering valve unit to the stationary bracket.

5. Lift steering valve unit up and out of the vehicle and place in a clean work area for disassembly.

DISASSEMBLY (Fig. 6)

1. Place the power steering unit in a vise, (Fig. 7). Remove the horn button and rubber cover by pushing down and turning to the right to disconnect it from the attaching wedges located on the base plate.

2. Remove the horn button contact cup, spring and contact washer. Remove the terminal from the horn cable and pull the cable and insulating ferrule from the steering column.

3. Remove the three round head screws from the horn button base plate, and remove the base plate and contact insulator.

4. Remove the nut and lockwasher securing the steering wheel to the column. Using a suitable puller, pull the wheel from the column.

5. Remove the retaining ring and first snap ring. Push shaft free of bearing with thumb pressure. When shaft is removed, bearing and second snap ring can be removed.

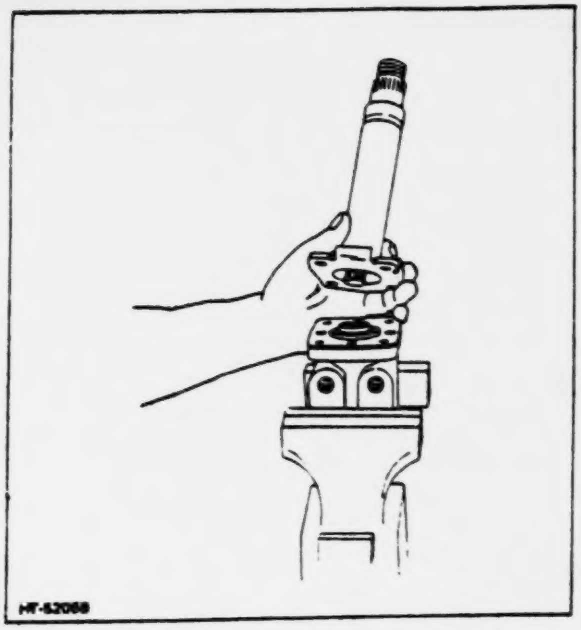


Figure 7. Removing Column From Housing

CAUTION: Do not use a hammer to free the shaft. Upper shaft bearing may be damaged.

6. Remove the two capscrews that secure the column to the lower unit. Match mark the capscrew holes so the ports will be in the proper direction when reassembled. Remove the column from the lower unit (Fig. 7).

7. Clamp the unit in the vise with the meter end up and remove the seven capscrews (Fig. 7). Remove the three-section cap, gear, and plate as a unit, and set to one side on the bench (Fig. 8).

8. Remove control assembly from vise, and check for free rotation of the control spool and sleeve parts with the column shaft (Fig. 10).

9. Place a clean wooden block across the vise throat to support spool parts. Clamp unit across port face with control end up and remove the four capscrews.

10. Hold the spool assembly down against the wooden block, and remove the end cap (Fig 11).

11. Inspect mating surfaces for obvious leakage, path wear, and seal condition.

12. Remove cap locator bushing (Fig 12.).

13. Place port face of housing securely on a solid surface and remove the spool-sleeve assembly from the 14-hole end of the housing.

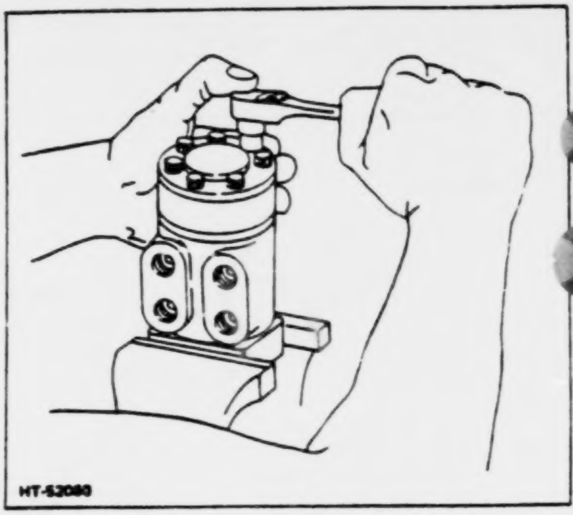


Figure 8. Removing End Plate Capscrews

CAUTION: Use extreme care when removing these parts, because they are very closely fitted and must be rotated slightly as they are withdrawn.

14. With a small bent tool or wire, remove check valve seal plug from housing (Fig. 13). Do not pry against edge of hole in housing bore.

15. With housing installed in vise, control end up, remove check valve seat with 3/16 hex wrench (Fig. 14).

16. Turn the housing over and tap lightly with palm of hand. With check valve

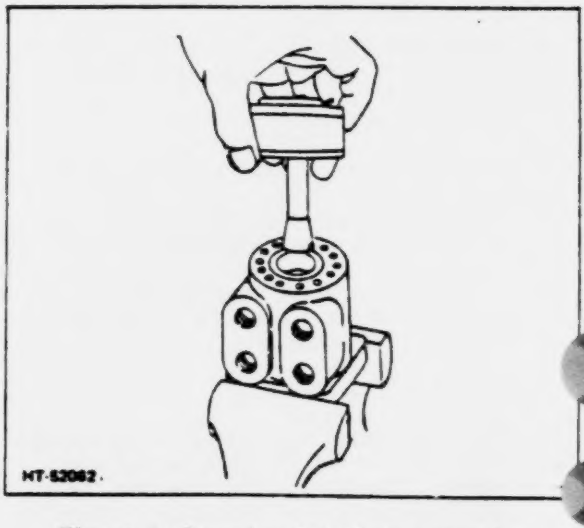


Figure 9. Removing End Plate Assembly

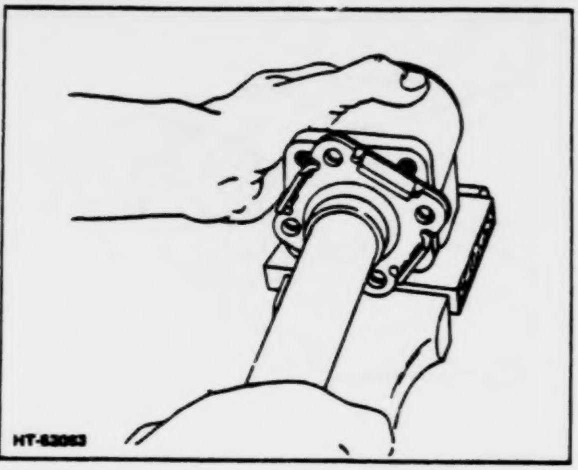


Figure 10. Checking Control Spool Rotation

hole toward lowest corner, remove check valve seat, ball, and spring.

17. Holding the spool assembly, push the cross pin to loosen it from the spool-sleeve assembly (Fig. 15). Remove the cross pin and set it aside.

18. Push inside lower edge of spool so the spool moves toward the splined end, and remove spool carefully from the sleeve (Fig. 16).

19. Push the centering spring set out of the spool (Fig. 17).

C. CLEANING AND INSPECTION

1. Carefully rinse each part with suitable solvent and allow parts to air dry. Parts should be set to dry on clean paper towels.

2. Inspect the surfaces of all moving parts for scoring and other damage. Slightly scored parts can be cleaned up by hand rubbing with 600-grit abrasive paper. Smooth burnished areas are normal in many areas. DO NOT attempt to clean up these areas, nor mistake them for excessive wear.

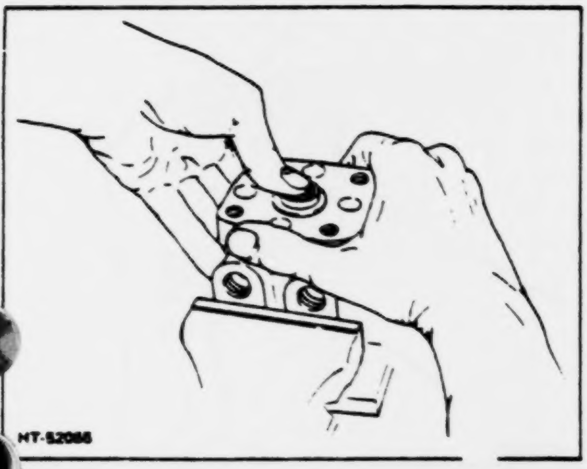


Figure 11. Removing End Cap

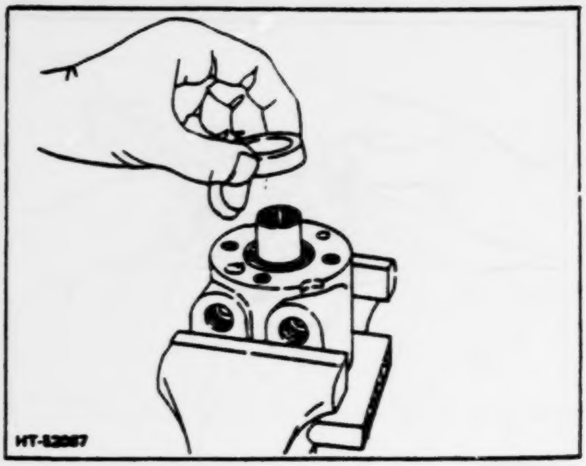


Figure 12. Removing Cap Locator Bushing

3. Replace any parts found to be defective or badly worn. All seals must be replaced with new parts when unit is reassembled.

4. Place a piece of 600-grit abrasive paper face up on a piece of plate glass or similar smooth, flat surface.

5. Clean the ends of the meter section star gear by stroking it across the abrasive. This will also remove any sharp grit which could scratch other meter section components.

6. Lightly clean up both sides of the ring gear, both sides of the plate, the 14-

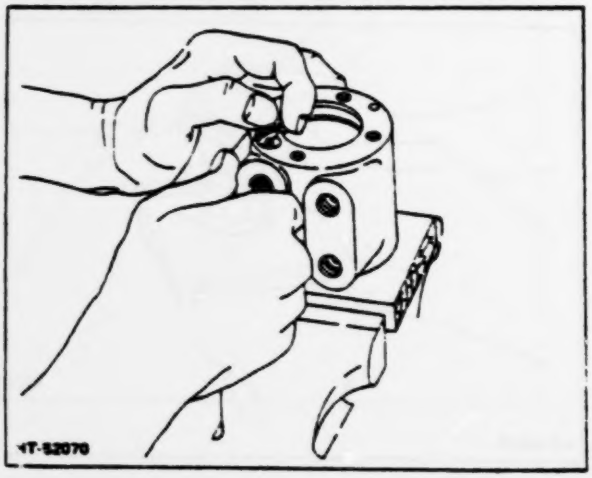


Figure 13. Removing Check Valve Seal Plug

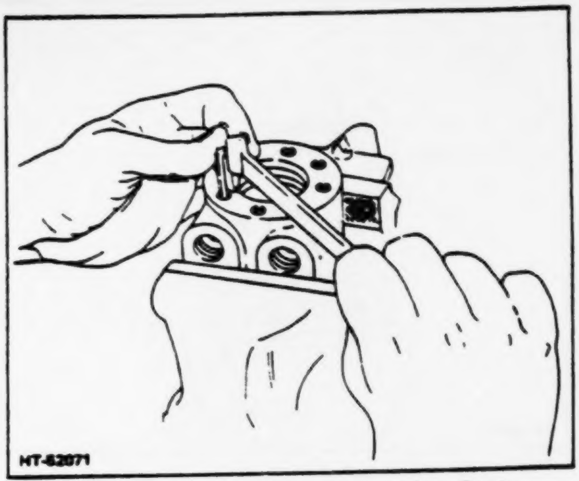


Figure 14. Removing Check Valve Seat

hole end of the housing, and the flat side of the end cap. Stroke each surface across the abrasive several times and check the results (Fig. 18). Any small bright areas indicates a burr which must be removed. When polishing the parts, hold them as flat as possible against the abrasive. After 6 to 10 strokes across the abrasive, check the part to see if it is polished. After each part is polished, rinse clean in solvent, blow dry with air, and place it where it can remain absolutely clean until reassembly.

D. REASSEMBLY

1. Lubricate all parts lightly with clean hydraulic oil at time of reassembly.
2. Install housing in vise with control end up and 14-hole end resting on a clean wooden block. Clamp lightly across the port surface and install check valve spring into check bore with large end down (Fig. 19).

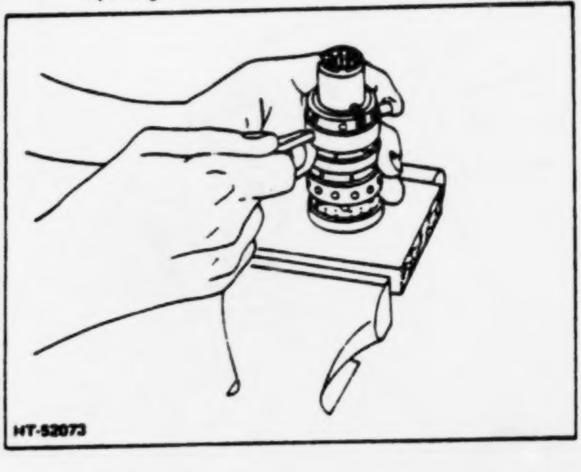


Figure 15. Loosening Spool Assembly

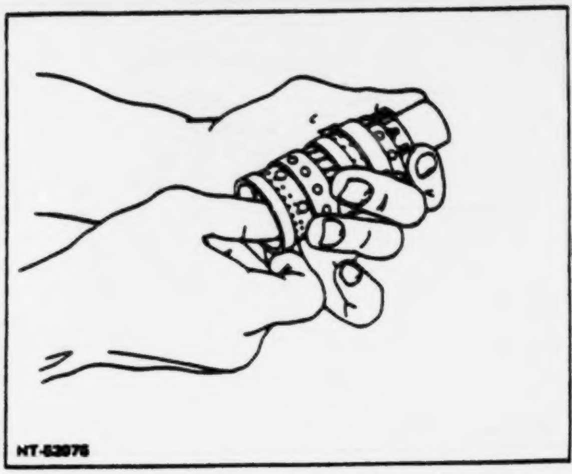


Figure 16. Removing Spool From Sleeve

3. Install check ball into check hole and make sure it rests on top of small end of spring.
4. Place the check valve seat on hex wrench and install it in the check valve hole so the machined counterbore seats on the ball. Tighten the seat to 150 lb-in (Fig. 20). Check ball action by pushing ball against the spring force with a small pin.

NOTE: Ball does not have to be snug against seat to function properly.

5. Carefully install the spool within the sleeve (Fig. 21). Be sure that spring slots of both parts are at the same end.

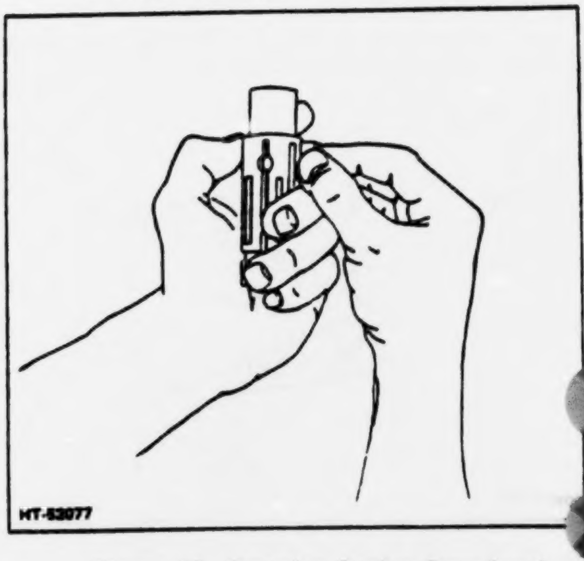


Figure 17. Removing Spring From Spool

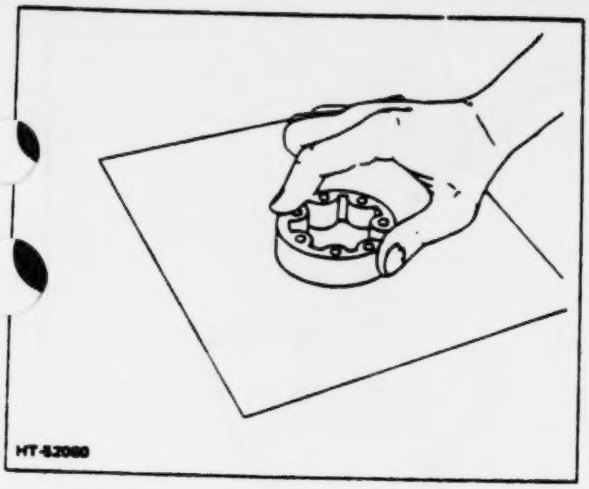


Figure 18. Polishing the Ring Gear

Rotate spool carefully while sliding parts together. Test for free rotation.

CAUTION: Spool must rotate smoothly in sleeve with finger tip force applied at the splined end.

6. With spring slots of the spool and sleeve in line, stand parts on end and insert spring installation tool through slots in both parts (Fig. 22). Position 3 pairs of centering springs (or 2 sets of three each) on bench so that extended edge is down and arched center section is together. In this position, enter one end of entire spring set into spring installation tool.

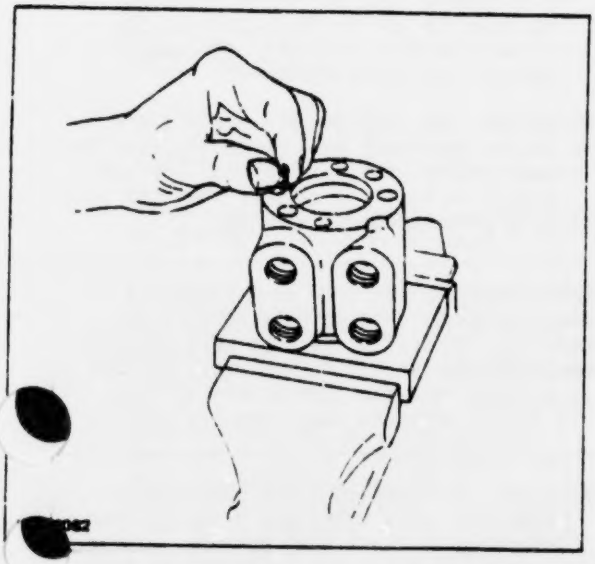


Figure 19. Installing Check Valve Spring

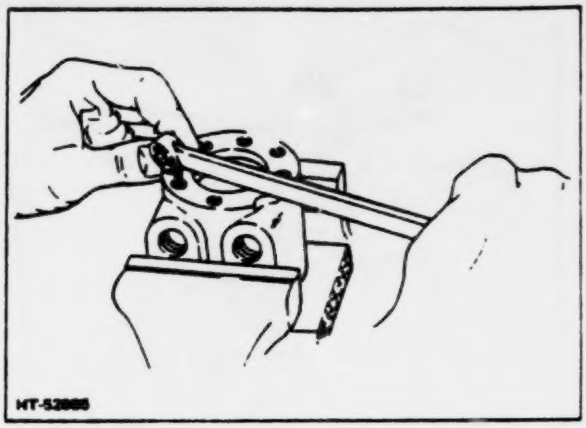


Figure 20. Tightening Check Valve Seat

NOTE: Tool is available as part number 600057 from Char-Lynn Company, 15151 Highway 5, Eden Prairie, Minnesota, 55343.

7. Compress extended end of centering spring set and push it into spool-sleeve assembly, withdrawing installation tool at the same time. Be sure the spring set is centered in the parts so they can be pushed down evenly and flush with the upper surface of the spool and sleeve.

8. Install the cross pin through the spool assembly and push into place until cross pin is flush or slightly below the sleeve

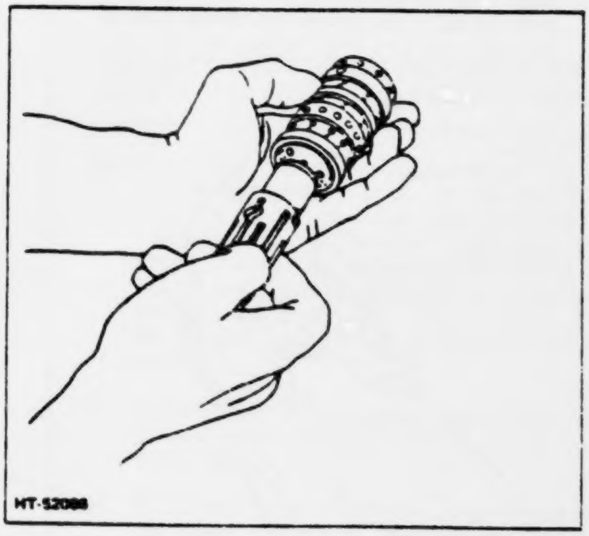


Figure 21. Installing Spool in Sleeve

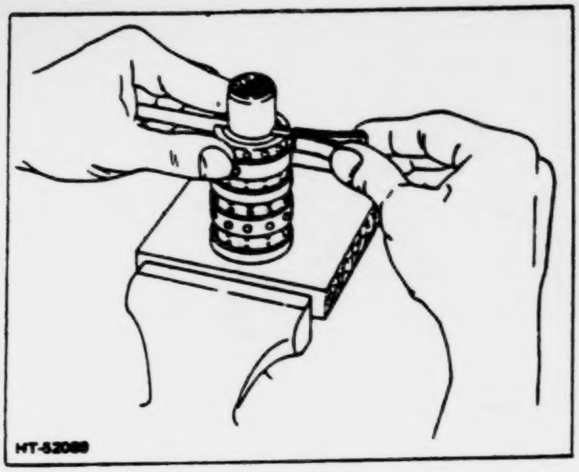


Figure 22. Installing Centering Spring Set

diameter at both ends.

9. Place the housing on a solid surface with the port face down. Install the spool assembly with the splined end of the spool entering the 14-hole end of the housing first (Fig. 23). Push parts gently into place with a slight rotating motion.

CAUTION: Exercise extreme care so the parts do not cock out of position while entering.

10. The spool assembly should be installed within the housing bore until it is flush with the 14-hole end of the housing. Do not install the spool assembly beyond this point, because the cross pin may drop into the discharge groove of the housing. With spool assembly in this flush position, check for free rotation within the housing by turning with light finger force at the splined end. Hold the parts in this position and place the 14-hole end of the assembly on the wooden block in the vise throat and clamp lightly across the port face with the vise.

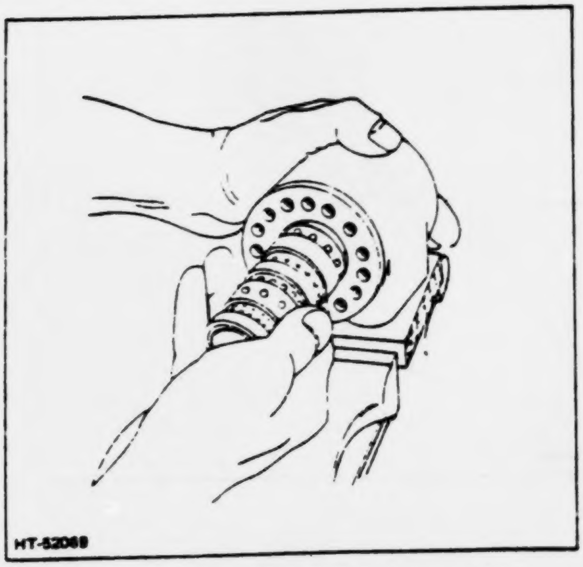


Figure 23. Installing Spool Assemoly

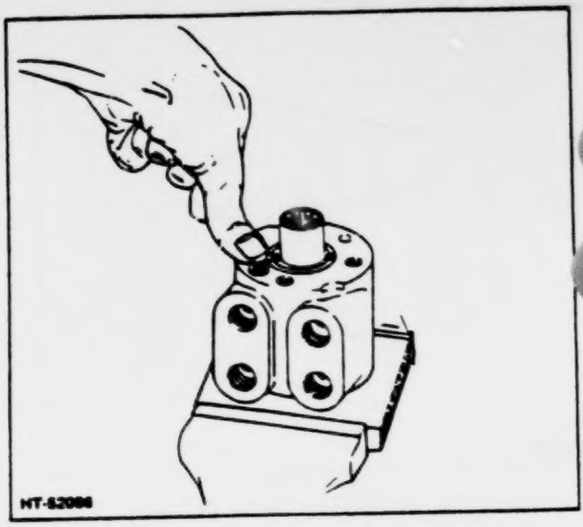


Figure 24. Rocking Check Plug During Installation

11. Install a new O-ring on the check plug, and install the plug in the housing, (Fig. 24). Exert a steady pressure on the plug, rocking it slightly so the O-ring feeds in smoothly wihtout cutting.

12. Insert the cap locator bushing, large O.D. chamfer up, partially into the housing. Rotate the bushing with the fingers to seat it flatly and smoothly against the spool assembly.

13. Install new mounting plate and shaft seals. Push each seal carefully into the seal groove with the fingers. The seal groove is slightly smaller than the seal to provide adequate sealing.

NOTE: The thin oil seal at exterior of mounting plate is used only to seal out dirt and generally does not need replacement. However, if it is replaced, it must be pressed into the counterbore so that the lip is directed away from the unit.

14. Place the mounting plate subassembly over the spool shaft and slide it down smoothly in place over the cap locator bushing so that seals will not be disrupted in assembly (Fig. 25).

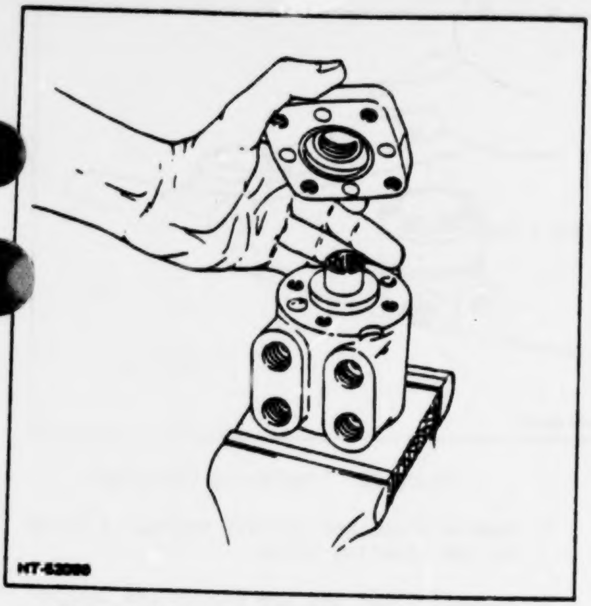


Figure 25. Installing Mounting Plate

15. Align the bolt holes in the cover with the tapped holes in the housing. Be sure the mounting plate rests fairly flush against end of housing assembly so that the cap locator bushing is not cocked. Install the 4 mounting plate capscrews and torque gradually and evenly to a setting of 250 lb-in. (Fig. 26).

16. Reposition housing in vise and clamp across the edges of the mounting plate. Be sure the spool and sleeve are flush or slightly below the 14-hole surface of the housing.

17. Wipe the upper surface of the housing clean with the palm of your hand or with your thumb. Clean each part of the flat surfaces in a similar way as it is ready for assembly.

18. Install the plate over this assembly so the bolt holes in the plate are aligned with the tapped holes in the housing.

19. Place the meter gear ring on the assembly so the bolt holes are aligned.

20. Install the splined end of the drive into the meter gear star so the slot at the control end of the drive is aligned with the valleys between the meter gear teeth (Fig. 27).

21. Push splined end of drive through the gear until spline extends about one-half its length beyond meter gear star. Hold it in this position while installing it in the unit. Note position or direction of cross pin within the unit.

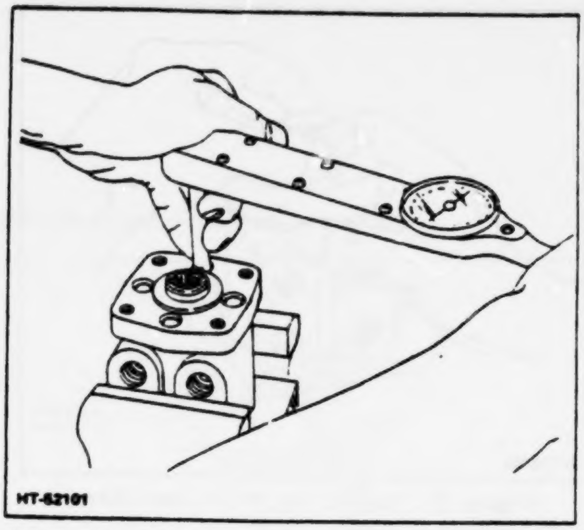


Figure 26. Tightening Mounting Plate Capscrews

Install the meter gear star into the meter gear ring and slowly position the parts so the drive does not become disengaged from the meter gear star. Hold the plate and meter gear ring in position on the assembly while the star is being installed. Rotate the meter gear slightly to engage the cross slot of the drive with the cross pin and the splined end of the drive will drop down against the plate.

CAUTION: Alignment of the cross slot in the drive with the valleys between the teeth of the meter gear star determines the proper valve timing of the unit. There are 12 teeth on the spline and 6 on the star. Alignment will be right in 6 positions and wrong in 6 positions. Should the parts slip out of position during this part of the reassembly, make certain that proper alignment is obtained.

22. Place the spacer in position at the end of the meter gear star. If spacer does not fit flush with the gear surface, the drive has not properly engaged the cross pin. After drive is correctly installed, place the meter end cap over the assembly. Install 2 capscrews, finger tight, to maintain alignment of the parts.

23. Install all 7 capscrews and torque them gradually and evenly to 150 lb-in (Fig. 28).

24. To install the steering column, rotate the shaft to engage the splines while bringing the surfaces into contact.

25. Install the capscrews and torque to 280 lb-in.

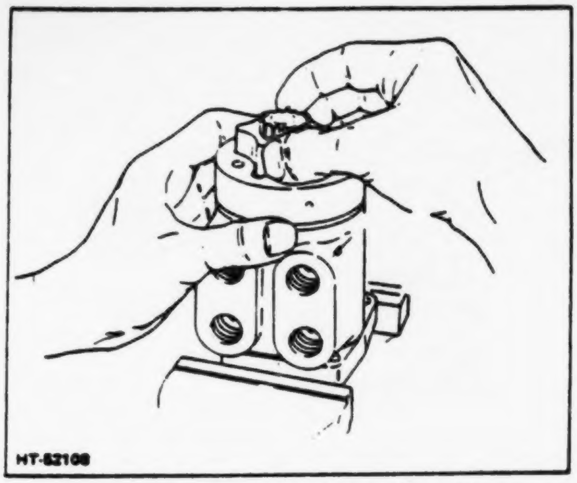


Figure 27. Installing Meter Gear Star

E. INSTALLATION

1. Position steering valve unit in truck and install attaching clamps and hardware.
2. Tighten bottom mounting hardware, then check column alignment and tighten upper mounting hardware.
3. Connect horn button wire to the horn.

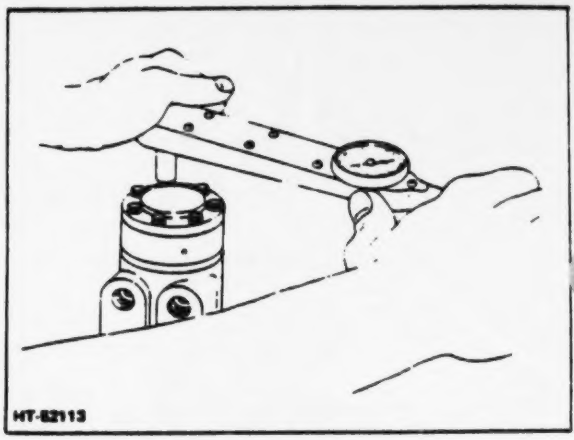


Figure 28. Tightening Capscrews

4. Remove plugs and connect hydraulic hoses to the steering valve.
5. Install floor and toe plates and secure with attaching hardware.

F. PUMP PRESSURE ADJUSTMENT

Refer to appropriate hydraulic pump in the HYDRAULIC SYSTEM, REPAIR MANUAL MODULE.

TOPIC 4. STEERING CYLINDER AND DRAG LINK

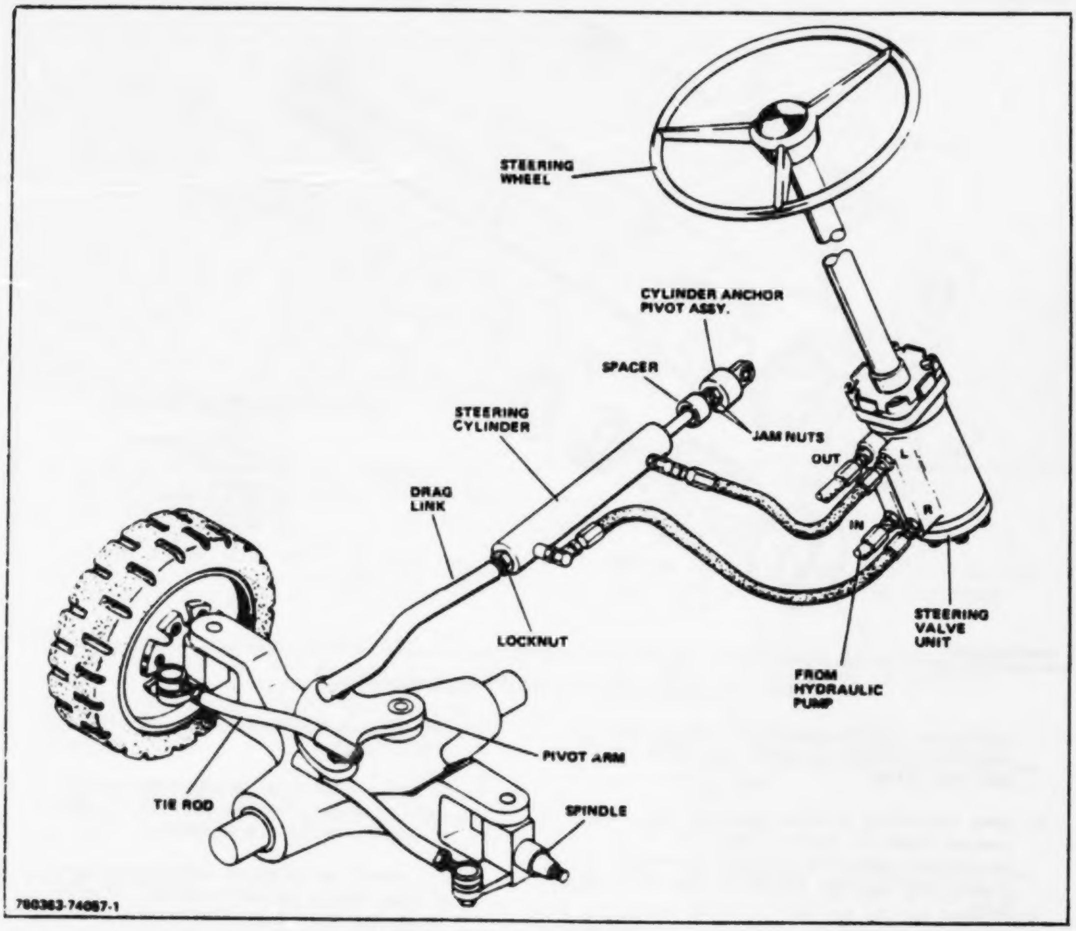

STEERING WHEEL
CYLINDER ANCHOR PIVOT ASSY.
SPACER
STEERING CYLINDER
JAM NUTS
OUT
L
R
IN
DRAG LINK
LOCKNUT
STEERING VALVE UNIT
FROM HYDRAULIC PUMP
PIVOT ARM
TIE ROD
SPINDLE
700363-74057-1

Figure 29. Power Steering System

A. REMOVAL

1. Attach a suitable hoist to the rear of the truck. Raise the rear of the truck until drag link and steering cylinder are accessible. Block front wheels for safety and place blocks under both sides of frame to support rear of truck.

2. Place a drain pan under cylinder ports and remove hoses from steering cylinder (Fig 29). Plug cylinder ports and hoses to prevent dirt from entering hydraulic system. Tag hoses for identification.

3. Loosen adjusting plug in end of drag link and remove drag link from pivot arm.

4. Disconnect drag link from steering cylinder by loosening locknut and unscrewing drag link from cylinder tube.

5. Remove cotter pin, washer, and anchor pin that secures anchor pivot assembly to cylinder anchor.

B. CYLINDER DISASSEMBLY

1. With cylinder firmly secured in bench vise hold plunger rod with proper wrench on flat spots and remove, anchor pivot assembly, jam nuts, and adjusting spacer from plunger rod.

2. Remove packing gland nut and pry out packing and wiper. Also remove O-ring, back-up ring, and nylon pellets.

3. When replacing O-ring, and back-up ring,

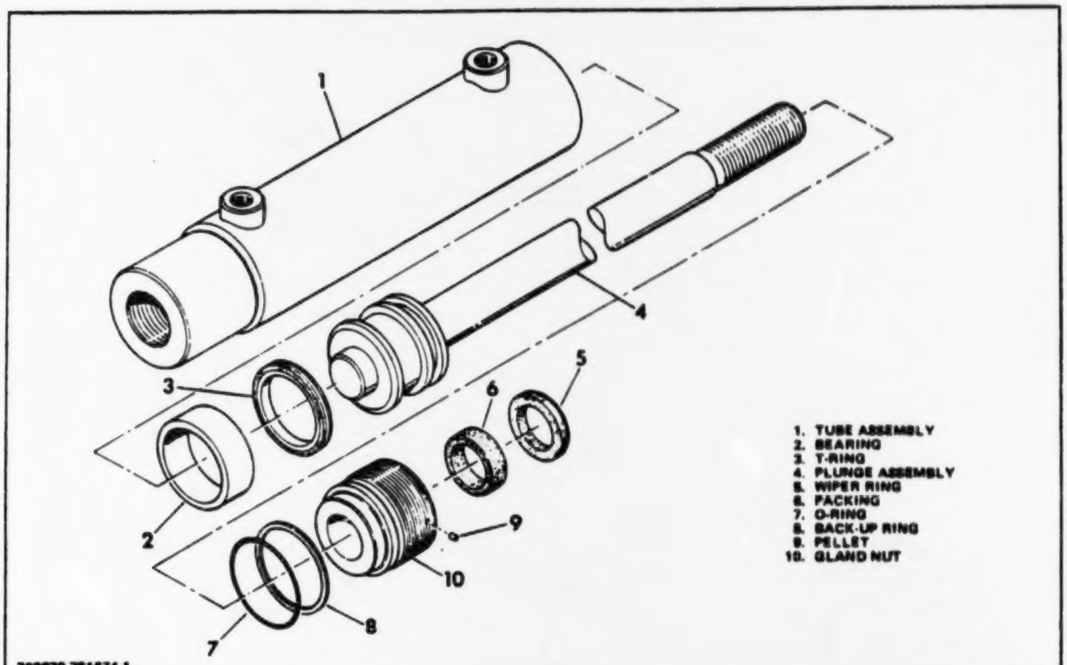


Figure 30. Power Steering Cylinder Components

lubricate with hydraulic oil and do not overstretch when sliding over edge of packing gland.

4. When replacing plunger packing seal, remove items in Steps 1 and 2 in this paragraph, and then withdraw complete piston and plunger assembly from cylinder tube.

CAUTION: Do not attempt to remove piston from plunger rod. They do not separate.

5. Remove bearing and packing from piston.

6. Thoroughly check cylinder bore for score marks or nicks. These cause damage to piston packing cups.

C. CYLINDER REPAIR

1. When packing starts to wear, renew it, otherwise parts of the packing will contaminate the oil and work into the pump or valve, thus causing damage, or malfunction.

2. Do not disassemble the unit any more than is required to replace the faulty packing.

3. Use only approved packing. Never make substitutions.

4. Before installing, inspect for nicks, cuts or flaws. Do not install if any of these faults are present.

5. All metal surfaces on which packing slides should be very smooth. If surfaces are scored or nicked, replace the parts or resurface them.

6. Soak packing in hydraulic oil before installing.

7. Sharp tools or instruments should not be used when installing packing.

8. When installing seal rings do not stretch them more than absolutely necessary.

9. Fit packing evenly and snugly without using undue force.

10. When packing must be installed over threads or sharp edges, use shim stock to protect packing.

   a. O-rings should be pushed over sharp edges with care. They can be easily cut.

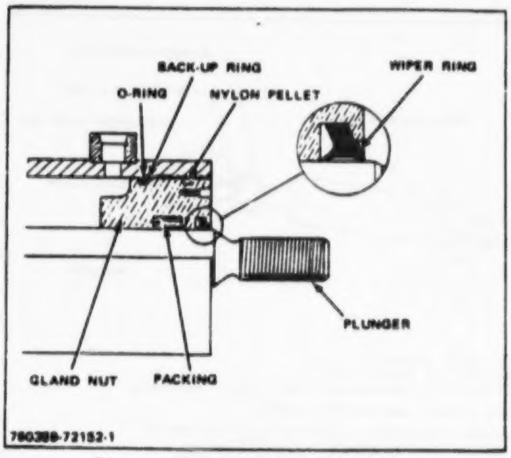


Figure 31. Cylinder Assembly

b. Usually no adjustment is required upon installation; make certain that O-rings are not twisted.

c. Check to see that the ring is of correct size to give a "squeeze" in the installed position.

11. Do everything possible to keep all hydraulic parts as clean as possible. Keep dirt and fine metal particles from packing and plungers. Such material can quickly damage packing and score plungers.

12. Inspect bushing and lube fitting in anchor pivot assembly. Replace any damaged or worn parts.

D. CYLINDER REASSEMBLY

Reverse disassembly procedure when installing new parts.

1. Install new packing and bearing on piston.
2. Install spacers on plunger rod. Be sure that outer spacer has an O-ring in groove.
3. Install piston and plunger assembly in cylinder tube.
4. Install new nylon pellets, O-ring, back-up ring, packing and wiper on paking gland nut.
5. Install packing gland nut on plunger assembly and cylinder tube. Gland nut must be flush with outer edge of cylinder tube.
6. Install adjusting spacer, jam nuts, and anchor pivot assembly on plunger rod.

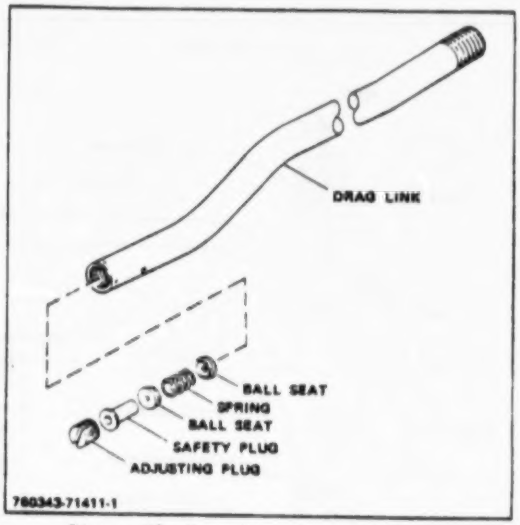


Figure 32. Drag Link Components

E. DRAG LINK DISASSEMBLY

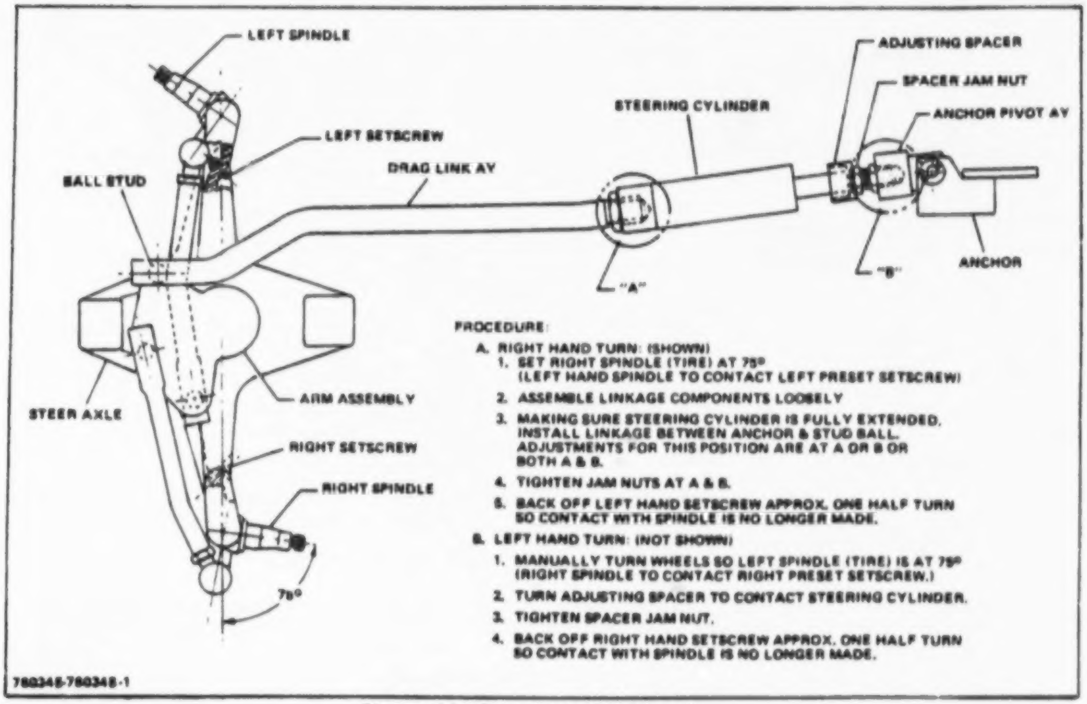
1. Remove adjusting plug, safety plug, ball seats and spring from drag link tube (Fig 32).
2. Clean all parts in a suitable solvent. Be certain all dirt and contaminants are removed.
3. Inspect all parts for cracks, nicks or other damage. Replace any parts that are worn or damaged.

F. DRAG LINK REASSEMBLY

Install one ball seat then the spring and the second ball seat followed by the safety plug and adjusting plug in the end of the drag link tube.

G. INSTALLATION

1. Place steering cylinder into position on truck and secure to mounting anchor with anchor pin, washer, and cotter pin. Cylinder should pivot freely in anchor.
2. First make certain locknut is on drag link and connect drag link to steering cylinder by screwing drag link into cylinder tube.
3. Connect drag link to pivot arm, screw in adjusting plug, and secure with cotter pin.
4. Remove plugs and connect hoses to power steering cylinder.
5. Make sure hoist is securely attached to


LEFT SPINDLE
LEFT SETSCREW
BALL STUD
DRAG LINK AY
STEERING CYLINDER
ADJUSTING SPACER
SPACER JAM NUT
ANCHOR PIVOT AY
ANCHOR
"A"
"B"
STEER AXLE
ARM ASSEMBLY
RIGHT SETSCREW
RIGHT SPINDLE
75°
760348-760348-1

PROCEDURE:

A. RIGHT HAND TURN: (SHOWN)
  1. SET RIGHT SPINDLE (TIRE) AT 75°
     (LEFT HAND SPINDLE TO CONTACT LEFT PRESET SETSCREW)
  2. ASSEMBLE LINKAGE COMPONENTS LOOSELY
  3. MAKING SURE STEERING CYLINDER IS FULLY EXTENDED, INSTALL LINKAGE BETWEEN ANCHOR & STUD BALL. ADJUSTMENTS FOR THIS POSITION ARE AT A OR B OR BOTH A & B.
  4. TIGHTEN JAM NUTS AT A & B.
  5. BACK OFF LEFT HAND SETSCREW APPROX. ONE HALF TURN SO CONTACT WITH SPINDLE IS NO LONGER MADE.

B. LEFT HAND TURN: (NOT SHOWN)
  1. MANUALLY TURN WHEELS SO LEFT SPINDLE (TIRE) IS AT 75°
     (RIGHT SPINDLE TO CONTACT RIGHT PRESET SETSCREW.)
  2. TURN ADJUSTING SPACER TO CONTACT STEERING CYLINDER.
  3. TIGHTEN SPACER JAM NUT.
  4. BACK OFF RIGHT HAND SETSCREW APPROX. ONE HALF TURN SO CONTACT WITH SPINDLE IS NO LONGER MADE.

Figure 33. Drag Link Adjustment

truck, raise truck, remove blocks, and lower truck to floor.

H. DRAG LINK ADJUSTMENT

1. Make certain pivot arm stop screws have been properly adjusted (Refer to TOPIC 2, paragraph G, PIVOT ARM STOP ADJUSTMENT).

2. Turn steering wheels to full right hand turn. Power steering cylinder rod should be fully extended and pivot arm screw should hit stop simultaneously.

3. If cylinder rod is out of adjustment loosen jam nuts (Fig 33) and turn rod in or out of anchor pivot until properly adjusted. Tighten jam nuts to 150-170 lb-ft.

4. Turn steering wheels to full left hand turn. Spacer (Fig 33) should strike cylinder tube and pivot arm screw hit stop simultaneously.

5. To adjust, loosen jam nuts and turn spacer in or out until properly adjusted. Tighten jam nuts to 150-170 lb-ft.

TOPIC 5. TIE RODS

A. REMOVAL

1. Remove cotter pins, adjusting plugs (Figs. 3, 4, and 5), ball seats, and springs from the tie rods, and separate the tie rods from the pivot arm.

2. Remove cotter pin and nut from ball socket, and remove the tie rods from the spindles. Loosen the nut on the ball socket, and remove the ball socket and nut from the tie rod tubes.

B. CLEANING AND INSPECTION

1. Clean all parts with mineral spirits or other suitable solvent, and dry with compressed air.

2. Inspect all parts for cracks, breaks, bends, other damage, and wear. Repair or replace parts as indicated by their condition.

3. Lubricate all parts except the ball sockets with an SAE 10 or 20 oil. Pack the tie rod ball sockets with high quality chassis lube.

C. INSTALLATION

Assemble the nut, ball socket, cup, seats, spring, and plug to tie rods. Position the tie rods on the pivot arm and tighten plug until seats firmly grasp ball stud on the pivot arm. Install ball socket on spindle and secure with nut and cotter pin.

D. TIE ROD ADJUSTMENT

Set the steer wheels straight ahead, parallel with the frame. If wheels are not parallel, adjust the tie rods to obtain this position. Zero degrees (0°) toe-in must be maintained at all times. To adjust tie rod, remove cotter pin and retaining nut that secures tie rod ball socket to steer wheel spindle. Remove ball socket from spindle and loosen nut that secures ball socket to tie rod. With the steer wheel parallel to the frame, turn ball socket IN or OUT until proper adjustment is obtained. Position ball socket in steer wheel spindle, install retaining nut securely, and install cotter pin; then tighten ball socket nut securely.

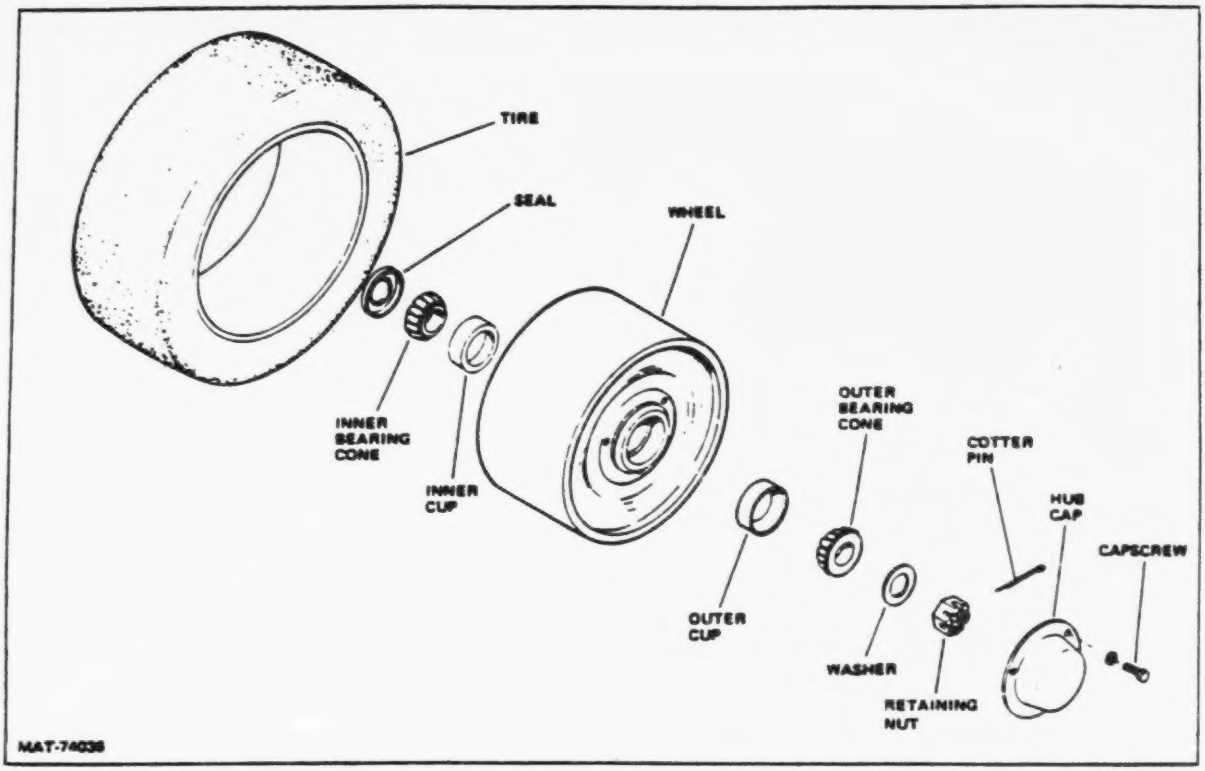


Figure 35. Steer Wheel Assembly

A. REMOVAL AND DISASSEMBLY

1. Attach a suitable hoist of adequate capacity to the rear of the vehicle and raise it sufficiently so the steer wheels clear the floor. Carefully place sturdy wooden blocks under both sides of the frame. Lower vehicle enough to take stress off the hoist and so the steer wheels clear the floor and the wooden blocks.

2. Remove the capscrews and lockwashers that secure the hub cap to the wheel and remove the hub cap (Fig. 35).

3. Remove the cotter pin, retaining nut, washer, and outer bearing cone from the spindle.

4. Carefully remove steer wheel and inner bearing cone from spindle.

5. If needed, remove bearings cups from wheel by driving them out with a soft punch.

> CAUTION: Use care when removing bearing cups to prevent damage to the bearing surface.

B. CLEANING AND INSPECTION

1. Wash bearing cones and cups thoroughly with solvent to remove grease. Tap the bearing cones against a block of wood to remove deposits, and rewash with solvent. Repeat cleaning process until all old grease and deposits are removed.

2. Wipe the spindle and wheel hub with a soft cloth soaked in solvent and dry with compressed air.

3. Inspect the bearing cones, bearing cups and spindles, for nicks, scratches, scoring and wear. Replace damaged or worn parts.

C. REASSEMBLY AND INSTALLATION

1. If removed, position the bearing cups

in the wheel, and press or drive the cups into their bores. Cups must be square with the bores, and fully seated at installation.

2. Lubricate the inner wheel bearing cone with specified grease. Use an applicator designed to force lubricant into the bearing rollers.
3. Position inner bearing cone on the spindle. Lubricate the bearing cups in the wheel and carefully install the wheel on the spindle.
4. Lubricate the outer bearing cone with the specified lubricant, using an aplicator. Install the bearing cone on the spindle.
5. Install washer and retaining nut on spindle. While rotating steer wheel, tighten retaining nut to a torque of 50 lb-ft; then back off nut until loose (0 lb-ft). Rotate wheel alternately in each direction while tightening retaining nut until a torque of 25 lb-ft is obtained. Then back off nut 30° min to 60° max and install cotter pin.
6. Install hub cap and secure with capscrews and lockwashers, tightening capscrews securely.
7. Raise vehicle slightly with the hoist and remove the wooden blocks from under the frame. Then lower vehicle so steer wheels rest on the floor. Remove hoist from rear of vehicle.

D. CUSHION TIRE REPLACEMENT

The wheels used on all cushion tire lift trucks are machined from castings. Any misalignment of the tire and wheel, while the tire is being pressed onto the wheel, can cause possible damage to the wheel. Because of this, a chamfer has been provided on the outside edge of the wheel and on the end of the inside diameter of the tire's metal insert. The chamfers help center the wheel and tire during the pressing operation and reduce the possibility of misalignment.

> CAUTION: To prevent damage to the wheel, the tire must be installed with the chamfered side of the wheel up.

To replace cushion tire, perform the following:

1. Remove wheel and tire assembly from lift truck.
2. Check inside diameter of metal insert of new tire. Remove any scale or rust with sandpaper. Clean inside of metal insert and lubricate it with bearing grease.

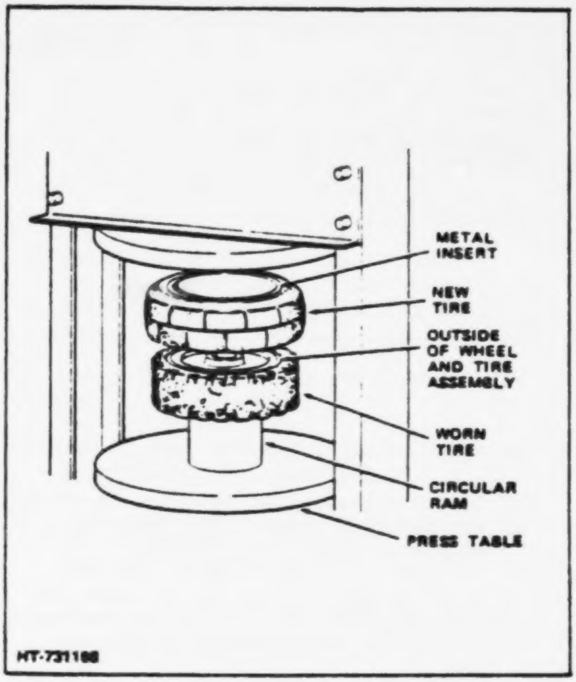


Figure 36. Cushion Tire Replacement

3. Place a circular ram (Fig. 37) on the press table. The length of the ram must be longer than the width of the old tire that is to be removed to allow complete removal of old tire. The outside diameter of the ram must be small enough to fit loosely in the insert of the tire, but must be large enough to rest squarely on the flat surface at the outer edge of the wheel.
4. If the outside edge of the wheel is not flush with the edge of the metal insert in the old tire, measure how far wheel is recessed inside the tire. New tire must be replaced at the same position that worn tire is installed on the wheel. A spacer, slightly smaller in diameter than the inside diameter of the tire insert and the same thickness as the depth of recess, can be used to obtain the proper amount of recess.
5. Position wheel assembly with worn tire on top of circular ram so outside of wheel is positioned upward. The outside edge of the wheel has a chamfer to help guide the new tire onto the wheel. The chamfered edge must always be the leading edge of the wheel whenever a tire is pressed onto a wheel.

6. Center the wheel assembly on top of the ram and make certain they mate-up squarely.

7. Position new tire on top of wheel and tire assembly. Align new tire and wheel so the two are concentric with each other.

8. Start pressing new tire onto wheel and worn tire off the wheel. Run press slowly for the first couple of inches of travel because this is the critical stage of the pressing operation. If tire begins to cock, stop press immediately and realign tire. A sharp jar with a soft headed mallet will usually realign tire on wheel. If wheel is to be recessed in tire, stop press after tire has been started on wheel. Position spacer (mentioned previously) inside the new tire so it rests squarely on the outer edge of wheel. Continue pressing operation until tire is correctly positioned on the wheel.

9. Release press; remove wheel and tire assembly and worn tire from press table. Wipe off grease and inspect wheel and tire assembly.

10. Install wheel and tire assembly on lift truck.

HYDRAULIC SYSTEM

TOPIC 1. HYDRAULIC PUMP

A. DESCRIPTION

The hydraulic pump (Fig 1-1) is a gear type unit driven directly from the engine. With this type of installation, the pump is always driven at engine speed.

The hydraulic pump consists of a housing, a combination end plate and mounting flange, gears, seals, bushings and capscrews. The housing also contains bores for the priority flow control valve, and the priority flow relief valve.

The relief valve pressure setting can be adjusted by turning the setscrew, located in the end of relief assembly, in or out. Turning the setscrew IN increases the spring pressure on the cone to increase the relief pressure setting, while turning the setscrew OUT will decrease the relief pressure.

When the hydraluic pump must be removed for replacement or repair, the following procedure is recommended:

B. REMOVAL

1. Remove radiator grille and components necessary to gain access to hydraulic pump.

NOTE: On truck applications where the hydraulic oil reservoir is below the supply line connection at the pump, it will not be necessary to drain the reservoir. Check reservoir to see if oil level is above or below the pump. If it is above the pump, oil will flow out of the supply (suction) line, when it is removed from the pump.

2. Disconnect hoses from fittings on hydraulic pump, and cap hoses to prevent contamination.
3. Remove capscrews and lockwashers attaching pump bracket to the engine and remove pump assembly.
4. Place the hydraulic pump assembly in a suitable work area for service.

C. DISASSEMBLY

1. Thoroughly clean outside of pump.
2. Remove capscrews which attach mounting flange to pump body. Remove flange.
3. Remove all accessible O Rings and backup rings.
4. Turn pump over, holding one hand over the front bushings and let them slide out. If bushings stick, tap body on a piece of wood to prevent marring mating surfaces. Place bushings on clean rag to prevent damaging surfaces.

NOTE: If the front bushings are excessively tight and difficult to remove, it indicates operation with dirty oil.

5. Set pump body face-up and remove drive shaft and idler shaft.
6. Invert pump body and allow rear set of bushings to slide out. See Step 4.
7. Remove the relief port plug and remove the relief valve components, laying them out in their order of removal.
8. Remove plug from rear of body and take out steering spool and spring.
9. Wash parts in solvent, blow dry with compressed air and inspect for damage.

D. INSPECTION

1. Check bushing bores near the front of the housing, using a 2" inside micrometer. If bores measure over 1.770, discard the pump body. This indicates pump has been subjected to excessive pressures, and the system should be checked to determine the cause.
2. Measure depth of grooves cut by the gears. If deeper than .005", it results in reduced flow of hydraulic oil. The gear track should have a smooth texture radially and should be darker color than the rest of the body. If it has a sandpaper like texture, and a light gray or silvery color (when dry), it indicates pump has been running on dirty or foamy oil. Flush hydraulic system before installing clean oil, and if pump body is to be reused, hone the face flat with a fine stone and clean thoroughly; use a fine sandpaper to remove any burrs left inside the bores.
3. Inspect the shaft seals in the end plate, and if they are not damaged or have not been leaking, they can be reused. Place a straightedge across the machined surface that faces the pump body. If the flange is bowed, do not reuse.

NOTE: Bowing of flange is caused by excessive pressures, and the cause should be determined before reinstalling the pump.

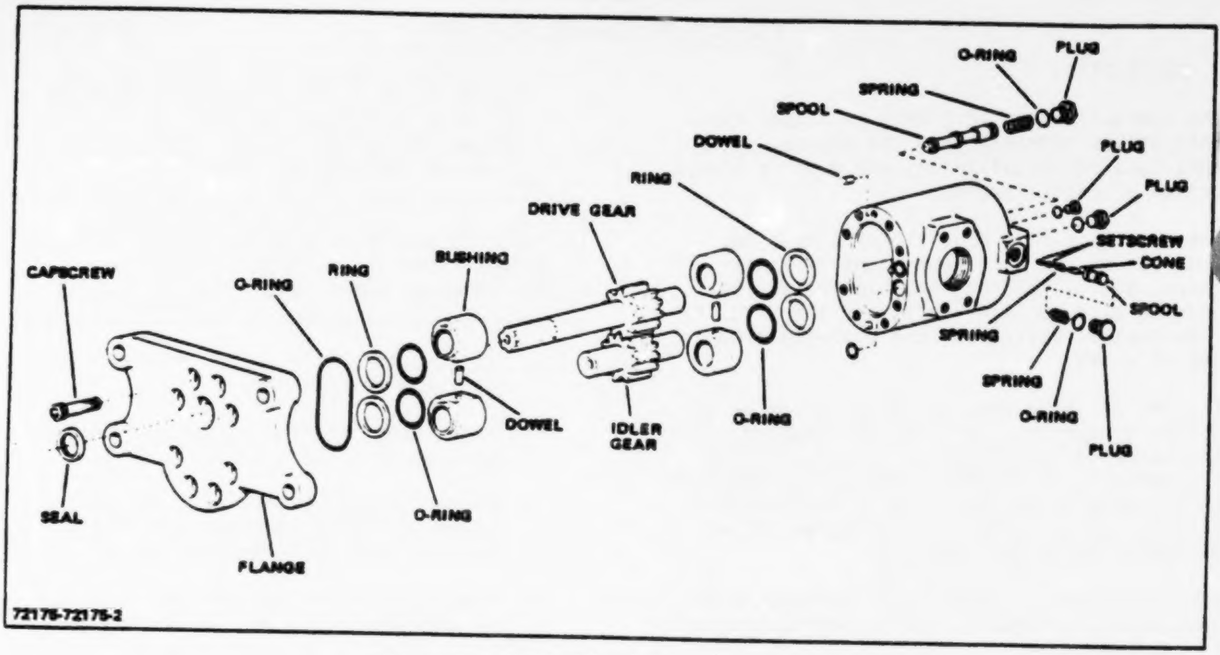


Figure 1-1. Hydraulic Pump

Looking at the plate from the pump side, measure the top left and lower right mounting holes. If the holes are larger than .441 diameter, replace the flange. This indicates pump has been running with mounting bolts loose. If flange is to be reused, hone same as body face.

4. Handle pump gears carefully when inspecting to prevent burring the teeth with resultant damage to the bushings. If the length of the gear is less than 1.320, or if gear O.D. is less than 1.754, the gear must be replaced. Check gear teeth ends and remove any burrs with a small, fine hone. If journal surfaces are blackened, and can be scratched with a pen knife, they have lost their case hardening and must be replaced.

5. When inspecting the bushings, they must be handled very carefully to prevent damage, as this makes them difficult to assemble and reduces their sealing effectiveness. The bore of the bushing, will be worn slightly oval, must not measure over 0.881 at the largest reading. The length of the bushing must not measure under 1.055. Minor cuts or scratches can be removed by honing in a circular motion with an extra fine stone. Be sure sharp edge between face of bushing and the O.D. is not broken. Erosion on the face of the bushing near the rectangular land and in the lube oil slot indicates dirt in the system.

6. Wash valve spool and dry with compressed air. It should slide freely in and out of its bore in the body. Check diameter of all lands and replace spool if any are less than .748. Check the balance and flow orifices and clear with a fine wire, if plugged.

7. Check valve spool spring to see that it is not bent or deformed. Replace if length is less than 3-1/2".

8. Inspect the relief valve plunger for wear and erosion and replace, if damaged.

9. If relief valve spring is bent or deformed, replace it. Replace if length is less than 0.80.

E. REASSEMBLY

Before reassembling pump, lay out all parts in a sequence in which they were removed and make sure all parts are perfectly clean.

1. Place pump face up and install the two body dowels, tapping them in place with a plastic hammer. Coat body bores with light oil.

2. Place the bushing O rings and the back-up rings on the shoulder at the rear of the rear bushings. Hold in place with grease, if necessary. Place the bushing dowel in the holes in the flat side of the bushings and holding the bushings together, carefully align them and slide them, O Ring side down, into the bores. Coat faces and bores of the bushings

with light oil.

CAUTION: Do not tap or force bushings into bores. They should slide to the bottom by hand force.

Be sure bushings bottom in housing and that back-up rings do not fall off.

3. Turn pump body so priority valve bore is to the left, then place drive gear (long shaft) in top bore and idler gear (short shaft) in lower bore. Coat journals and gear faces lightly with oil.

4. Place bushing dowel between the two front bushings. Hold bushings together, and insert face down into the pump bores.

CAUTION: Do not force bushings in. They will slide in smoothly if properly aligned.

Place the bushing O Ring and then the back-up rings on the bushing shoulders.

5. Place the two drain O Rings in the two small recesses in the face of the body on the inlet side of the pump and place the body O Ring in its recess around the bushings.

6. Place the priority valve spring in the valve spool, coat the spool with oil, and install it (spring end last) into the valve bore.

7. Install plug in spool bore.

8. To replace seals in the end plate, first press in the oil seal with the lip pointed in, then press in the air seal with the lip pointed out. Install the end plate on the pump, taking care not to damage the seals on the shaft. Before sliding end plate all the way down, check to see that all O Rings and back-up rings are still in place.

9. Tighten capscrews firmly. Turn shaft of pump to see if it has some drag, but can still be turned by hand.

10. Install the relief valve components in the same position from which they were removed in the relief valve bore. Tighten plug until it bottoms.

F. INSTALLATION

NOTE: If the splines of the original coupling are worn, replace coupling.

1. Install the pump and the mounting bracket onto the front of the engine. Reconnect the hydraulic lines to the hydraulic pump.

2. Check the hydraulic oil reservoir to be sure the oil level is correct. Run pump for one minute at no load, idle speed, to allow the system to fill. Check for any pressure or air leaks in the system at this time. After one minute of running, shut engine off and recheck oil level in reservoir. If low, fill to proper level as indicated by Full mark on oil level dipstick.

NOTE: If severe foaming is observed, it indicates a suction leak or improper oil, and must be corrected.

3. Set the main hydraulic relief pressure (adjustable valve located in control valve assembly) to the following:

1900-2000 psi

4. Install a pressure gauge (2000 psi) in the pressure side of the steering circuit. With the hydraulic pump operating at full speed, turn the steer wheels to their limit. The opening pressure should be set at 1100 psi by adjusting the pump relief valve setscrew IN or OUT.

5. Always start the hydraulic pump under no load conditions to prolong pump life. Refer to SPECIFICATIONS of LUBRICANTS for proper oil to use.

6. Install the radiator grille and components which were removed to gain access to the pump.

TOPIC 2. CONTROL VALVE

A. DESCRIPTION

The hydraulic control valve (Fig 2-1) contains two basic plunger sections (lift and tilt controls; additional plunger sections can be added for accessory unit control). Each of the sections may be replaced separately. All parts of the sections may be replaced individually, except the plunger section housings and their selectively fit plungers, which must be replaced as units.

The function of the control valve is to direct the flow of the hydraulic fluid, under pressure, to the appropriate cylinders.

The control valve contains an adjustable relief valve which protects the system against damage resulting from excessive pressure that builds up when the lift or tilt cylinders reach full stroke. Excessive pressure can also result from overloads. The relief valve should be adjsuted to unseat at 1.950 ± 50 psi.

The control valve requires very little attention with the exception of keeping the hydraulic lines and hose connections tight.

B. REMOVAL

The following procedure is recommended for proper control valve removal:

1. Make sure lift is collapsed and that mast is tilted all the way forward.
2. Disconnect control lever linkage if necessary to gain access for control valve removal. (On some new model trucks, the handles, linkage, and mounting bracket can all be removed along with the control valve.)
3. Disconnect and cap all hydraulic lines.

> NOTE: Properly tag all lines so that they will be reconnected to their proper ports.

4. Remove the mounting capscrews and control valve.
5. Clean outside of valve with a solvent and dry with compressed air.
6. Remove all fittings and place control valve in a suitable work area.

C. DISASSEMBLY

During disassembly, particular attention should be given to identification of parts for reassembly. Spools are selectively fitted to valve bodies and must be returned to the same bodies from which they were removed. Valve sections must be reassembled in the same order.

1. Remove the four tie studs and nuts and separate the valve sections. Be careful not to destroy or lose spacers.
2. Remove the two screws which secure the spool end cap and remove the cap (and switch bracket, if used). If the cap has a detent assembly, screw out the detent plug and remove the spring and piston. Remove the O Ring from the cap.
3. Slide the spool out of its bore and remove the O Rings from the groove in the spool and from the valve body around the spool bore. Do not remove the centering spring, retainers or the spool extension unless it is necessary to replace them.
4. Grip the stem of the check valve plug with pliers and pull it out of the valve body. Remove the O Ring and back-up ring. Remove the spring and ball from the valve body.
5. Screw out the plug which retains the relief valve and remove the O Ring from the plug. Remove the spring and the relief valve sub-assembly. Remove the solid plug.
6. Remove the fitting, O Rings and back-up ring.

D. CLEANING, INSPECTION AND REPAIR

1. Discard all old seals. Wash all parts in a clean mineral oil solvent and place them on a clean surface for inspection.
2. Carefully remove by light lapping. Be certain there is no paint or burring on mating surfaces of valve bodies.
3. Inspect the valve spools and bores for burrs and scoring. If scoring is not deep enough to cause objectionable leakage, the surfaces can be polished with crocus cloth. If scoring is excessive, the valve body and spool must be replaced. Check the valve spool for freedom of movement in the bore.
4. Check the relief valve for smooth movement in its bore. The valve should move from its own weight.

E. REASSEMBLY

> NOTE: Coat all parts with clean hydrauilc oil to facilitate assembly and provide initial lubrication. Petroleum jelly can be used to hold seal rings in place on assembly.

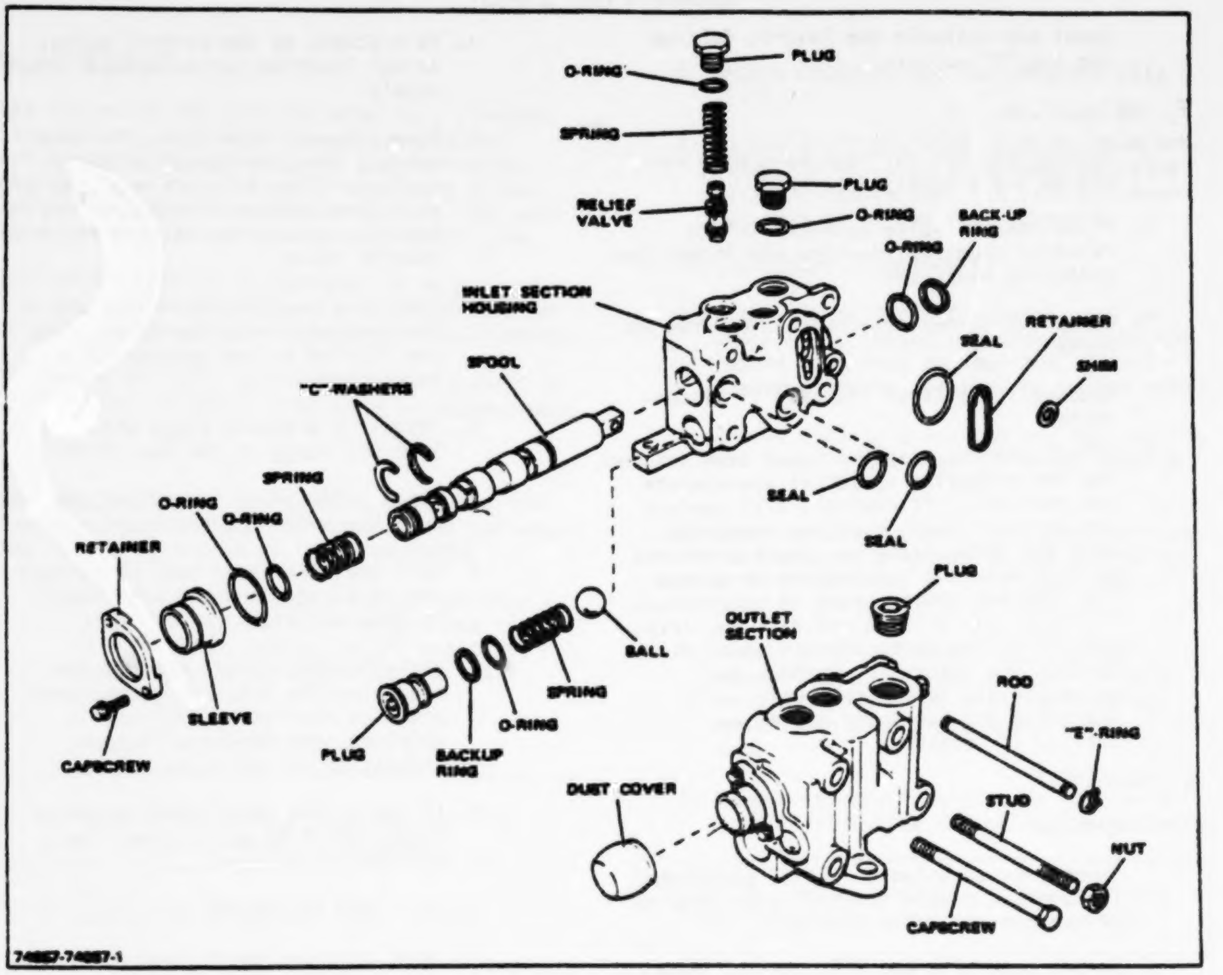

PLUG
O-RING
SPRING
RELIEF VALVE
PLUG
O-RING
BACK-UP RING
O-RING
INLET SECTION HOUSING
RETAINER
SEAL
SHIM
SPOOL
"C"-WASHERS
SPRING
O-RING
O-RING
RETAINER
SEAL
SEAL
PLUG
OUTLET SECTION
BALL
SPRING
O-RING
BACKUP RING
PLUG
SLEEVE
CAPSCREW
ROD
"E"-RING
STUD
NUT
DUST COVER
CAPSCREW

Figure 2-1. Control Valve

1. Install the back-up ring and then the O Rings on the fitting. Tighten the fitting securely, but DO NOT over tighten.

2. Install the O Ring on the relief valve plug. Place the relief valve assembly in its bore, hex nut end up. Install the spring and plug and tighten the plug securely but DO NOT over tighten.

3. Install a new back-up ring and O Ring on the check valve plug with the O Ring toward the spring and ball. Place the ball and spring in the body and install the plug. Be sure the hole in the plug lines up with the stud hole in the body. Check valves are not used in "B" spool sections.

4. If the centering spring was removed, install the spring and retainers on the spool. Place the O Ring in the groove around the spool bore and install the O Ring on the spool. Install the spool in the bore.

5. Install the O Ring in the end cap groove and install the cap, switch bracket (if used) and attaching screws. Torque the screws securely. On models with detents, grease all the detent parts. Install the end cap and check for proper spool extension alignment. Install the piston, spring and plug. Be sure to screw the plug in all the way.

CAUTION: Make sure all mating surfaces of valve bodies are free of burrs and paint.

6. Install seal rings and the seal ring retainer in the grooves in the body of each inlet and center section. Use petroleum jelly to hold the seals in place. Carefully place the sections together in the same order in which they were removed. Coat the stud threads with "Loctite" or similar sealant and install the studs. Tighten the nuts to 15 lb ft torque. If levers are used, install pins in each

spool and assemble the levers, fulcrum rod and "E" washers.

F. INSTALLATION

1. Ensure that all fittings have been replaced and properly tightened.
2. Place control valve assembly in its relative mounting location and insert the attaching capscrews.
3. Uncap and connect the hydraulic lines as marked.
4. Reconnect the lever linkages if disconnected.
5. After complete reassembly has been assured, run the hydraulic system (i.e., operate the control, lift control, tilt control and any auxiliary functions associated with the hydraulics) for about 5 minutes to eliminate any air present in system. The internal construction of the hydraulic reservoir will "bleed-off" any trapped air in the hydraulic oil as it flows through the reservoir. Recheck the hydraulic oil level (reservoir) after operating the hydraulic system and refill, if necessary.

G. ADJUSTMENT

1. Linkage

Improperly adjusted or out of adjustment linkage can result in binding or bending of the control valve linkage.

Ensure that tilt and lift control levers and associated linkage travel freely and smoothly, through forward and backward movement, of each lever and that the control valve plungers respond accordingly. Adjust, bend, repair, or replace as necessary.

Be certain that pivot points or other mating surfaces are free of accumulated sludge and remain lightly lubricated to function smoothly.

2. Relief Valve Adjustment

Whenever the control valve or hydraulic pump has been repaired or replaced, check the relief valve and adjust to open at specified pressure. Check and adjust the relief valve (Fig 2-1) located in the lift section of the control valve as follows:

a. Gain access to the control valve; actual location varies between truck models.

b. Some adapters have a plug in them where a pressure gauge can be installed. If unit is not equipped with this type adapter, disconnect the hydraulic tube at the inlet part of the control valve.

c. Install a tee fitting on the end of the hydraulic tube and connect the tee fitting to the adapter in the inlet port.

d. Install a pressure gauge with a 0 to 3000 psi range in the tee.

e. Place shift lever in neutral position, turn key switch ON and start engine.

f. Pull the tilt lever back to retract the lift cylinders and hold lever in this position.

g. While holding lever, observe the needle on the pressure gauge. When pressure reading of 1950 psi is attained, the needle will stop, indicating relief valve opening.

h. If the relief valve opens below or above 1950 ± 50 psi, it must be adjusted as follows:

(1) Turn key switch OFF.

(2) When pressure gauge reads zero, remove relief valve plug.

(3) Check relief valve assembly and valve spring for damage. Replace defective parts.

(4) Install valve assembly with spring, O Ring, and plug.

(5) Repeat Steps e through g.

i. Turn key switch OFF.

j. Remove pressure gauge and tee; then install hydraulic tube to control valve fitting.

TOPIC 3. TILT CYLINDER

A. DESCRIPTION

The action of the tilt cylinder is a straight line motion. Any misalignment between the cylinder and the piston will cause binding, rapid wear of packing and the packing gland, rapid wear of piston rod and packing, and will tend to break the weld on the cylinder case.

The welded section is designed to hold hydraulic pressure and should not be called upon to sustain any bending action due to misalignment.

To remove the tilt cylinder for replacement or repair, the following procedure is recommended:

B. REMOVAL

The tilt cylinders are mounted under the toe plate and floor plate. To remove tilt cylinders the following procedure is recommended:

1. Set hand brake. Operate tilt cylinder lever and put mast in forward position. Turn ignition switch to OFF position. Secure mast in position with a chain hoist.

2. Remove cotter pin and yoke pin.

> CAUTION: Protect tilt cylinder rod from truck frame and handling mishaps.

3. Remove toe plate and floor plate.

4. Disconnect hydraulic lines at tilt cylinder.

5. Remove capscrew and pin retainer (Fig 3-1).

6. Insert drift pin (Fig 3-2) in hole provided for it in tilt cylinder mounting pin, and remove pin. The tilt cylinder may then be lifted from location.

C. TILT CYLINDER DISASSEMBLY

1. With tilt cylinder firmly secured in bench vise, loosen capscrew on yoke and remove yoke from plunger rod. Record number of turns required to remove yoke.

2. Remove packing gland and pry out packing and wiper. Also remove O Ring, back-up ring, and nylon pellets.

3. When replacing O Ring, and back-up ring, lubricate with hydraulic oil and do not overstretch when sliding over edge of packing gland.

4. When replacing plunger packing seal, remove items in Steps 1 and 2 in this paragraph, and then withdraw complete piston and plunger assembly from cylinder tube.

5. Remove spacers from plunger rod. An O Ring is installed in the end spacer only.

> CAUTION: Do not attempt to remove piston from plunger rod. They do not separate.

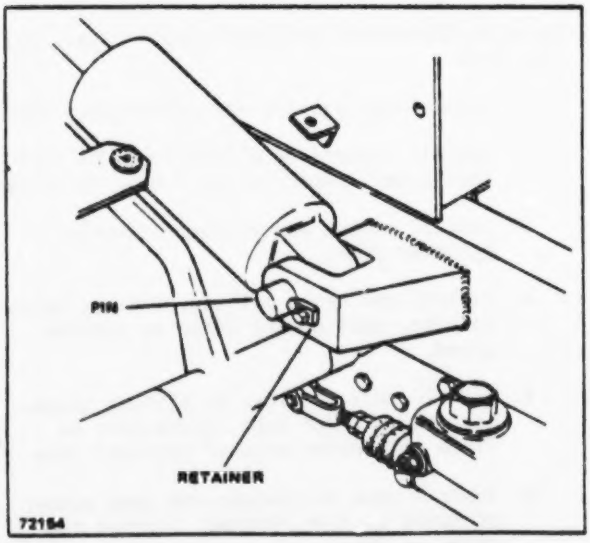


Figure 3-1. Tilt Cylinder Anchor Pin

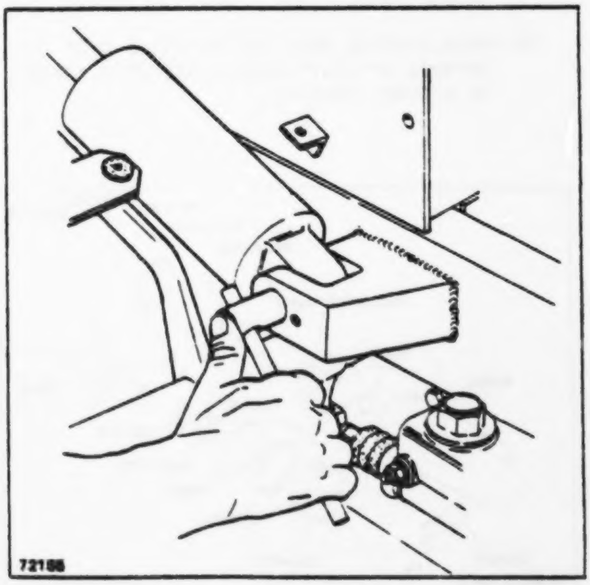


Figure 3-2. Tilt Cylinder Pin Removal

6. Remove bearing and packing from piston.

7. Thoroughly check cylinder bore for score marks or nicks. These cause damage to piston packing cups.

D. TILT CYLINDER REPAIR

1. When packing starts to wear, renew it otherwise parts of the packing will contaminate the oil and work into the pump or valve, thus causing damage, or malfunction.

2. Do not disassemble the unit any more than is required to replace the faulty packing.

3. Use only approved packing. Never make substitutions.

4. Before installing, inspect for nicks, cuts or flaws. Do not install if any of these faults are present.

5. All metal surfaces on which packing slides should be very smooth. If surfaces are scored or nicked, replace the parts or resurface them.

6. Soak packing in hydraulic oil before installing.

7. Sharp tools or instruments should not be used when installing packing.

8. When installing seal rings do not stretch them more than absolutely necessary.

9. Fit packing evenly and snugly without using undue force.

10. When packing must be installed over threads or sharp edges, use shim stock to protect packing.

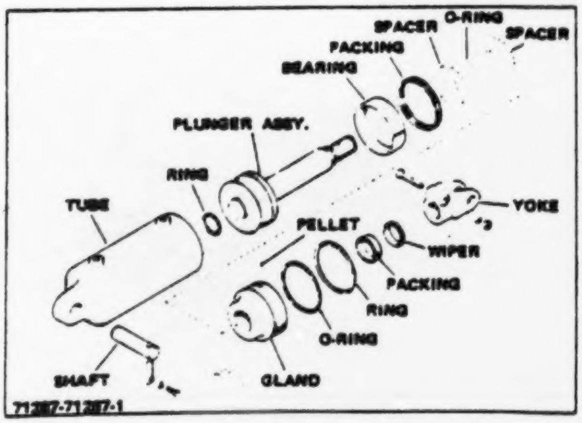


Figure 3 -3. Tilt Cylinder Components

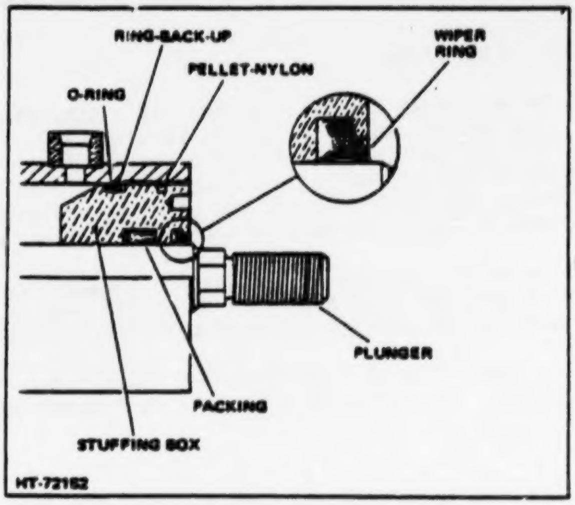


Figure 3-4. Tilt Cylinder Assembly

a. O Rings should be pushed over sharp edges with care. They can be easily cut.

b. Usually no adjustment is requried upon installation; make certain that O Rings are not twisted.

c. Check to see that the ring is of correct size to give a "squeeze" in the installed position.

11. Do everything possible to keep all hydraulic parts as clean as possible. Keep dirt and fine metal particles from packing and plungers. Such material can quickly damage packing and score plungers.

E. TILT CYLINDER REASSEMBLY

Reverse disassembly procedure when installing new parts.

1. Install new packing and bearing on piston.

2. Install spacers on plunger rod. Be sure that outer spacer has an O Ring in groove.

3. Install piston and plunger assembly in cylinder tube.

4. Install new nylon pellets, O Ring, back-up ring, packing and wiper on packing gland.

5. Install packing gland on plunger assembly and cylinder tube. Gland must be flush with outer edge of cylinder tube.

6. Install yoke on plunger rod same number of turns as when removed. Tighten capscrew on yoke.

F. INSTALLATION

1. Place the tilt cylinder in the mounting bracket lining up holes and insert mounting pin.
2. Install pin retainer and capscrew.
3. Install hydraulic lines, making sure connections are tight. Check for leakage before installing toe and floor plate.
4. Install yoke pin at back of mast. Install cotter pin.
5. Check tilt cylinders to make sure they bottom simultaneously.

MEMO

MASTS, CARRIAGES AND FORKS

TOPIC 1. MASTS

A. DESCRIPTION

The conversion of the hydraulic system fluid energy into mechanical energy necessary in lift truck operation is accomplished by the mast assembly. An EXTRA LIFT mast is available for all models of lift trucks, while the HIGH FREE-LIFT, TRI-LIFT, TRI FREE-LIFT and TRI-MAX masts are available for certain model trucks only.

The extra-lift and the high free-lift masts are basically the same in construction with two structural uprights. The difference between the two is the type of lift cylinder used and its mounting arrangement within the mast structure. The TRI-LIFT, TRI FREE-LIFT and TRI-MAX masts consist of a nested assembly of three (3) structural uprights (channels) or beams.

All masts but the TRI-LIFT, and some of the larger capacity TRI-MAX models, utilize two (2) lift chains for safety and to minimize off-center loading. Due to the operational mechanization, all TRI-LIFT and some of the larger capacity TRI-MAX masts, make use of four (4) lift chains. The chain anchors are individually adjustable to ensure equal tension and a level fork carriage. The chains are centrally located so as to offset any bending action on the lift cylinder plunger(s).

Should it become necessary to re-center the mast channel uprights for smooth and even sliding, the following alignment mechanics are provided (adjustment method varies with the model and load capacity of mast employed): a - Wear plates and aligning shims; b - Roller bearings and aligning shims; c - Adjusting plugs. Each of these methods of adjustment will be discussed in detail in the applicable mast service topics.

The removal procedure for all masts is essentially the same and is recommended as outlined as follows.

B. REMOVAL

1. Remove the carriage forks.

2. Block the inner mast to give 20" to 24" clearance between bottom of mast and floor.

NOTE: Remove the capscrews and spacer from the carriage roller supports, if applicable.

3. Attach a suitable chain hoist to carriage assembly. Remove chain anchor pins and disconnect chains from carriage.

4. Lower carriage out of bottom of inner mast, and move to the side, away from work area. Remove chain hoist.

5. With mast fully lowered, attach a sling from an overhead crane to the mast lift-eyes to secure entire mast assembly during removal.

CAUTION: Be certain overhead hoist is rated to safely support mast assembly weight.

CAUTION: Fully retract or lower lift cylinders.

6. Disconnect tilt cylinders from outer mast.

7. Disconnect hydraulic line(s) from lift cylinder(s).

8. Raise overhead crane high enough to relieve pressure on the mast pivot pins. Remove pivot pins from mast and lift truck frame; use crane to lay mast flat on suitable supports with cylinder(s) (cluster) facing up.

C. TRI-MAX MAST (CLUSTER TYPE) DISASSEMBLY AND INSPECTION

1. Remove the lift cylinder cluster assembly and intermediate lift cylinder assembly (refer to TRI-MAX CYLINDER CLUSTER REMOVAL Topic).

2. Remove the cylinder bracket from the top support on the intermediate mast section, and disassemble and remove the channel restraint interlock assembly. (Refer to Figure 1.)

3. Carefully slide the inner and the intermediate mast sections out of the top of the outer mast section, then remove the inner mast section from the intermediate mast section.

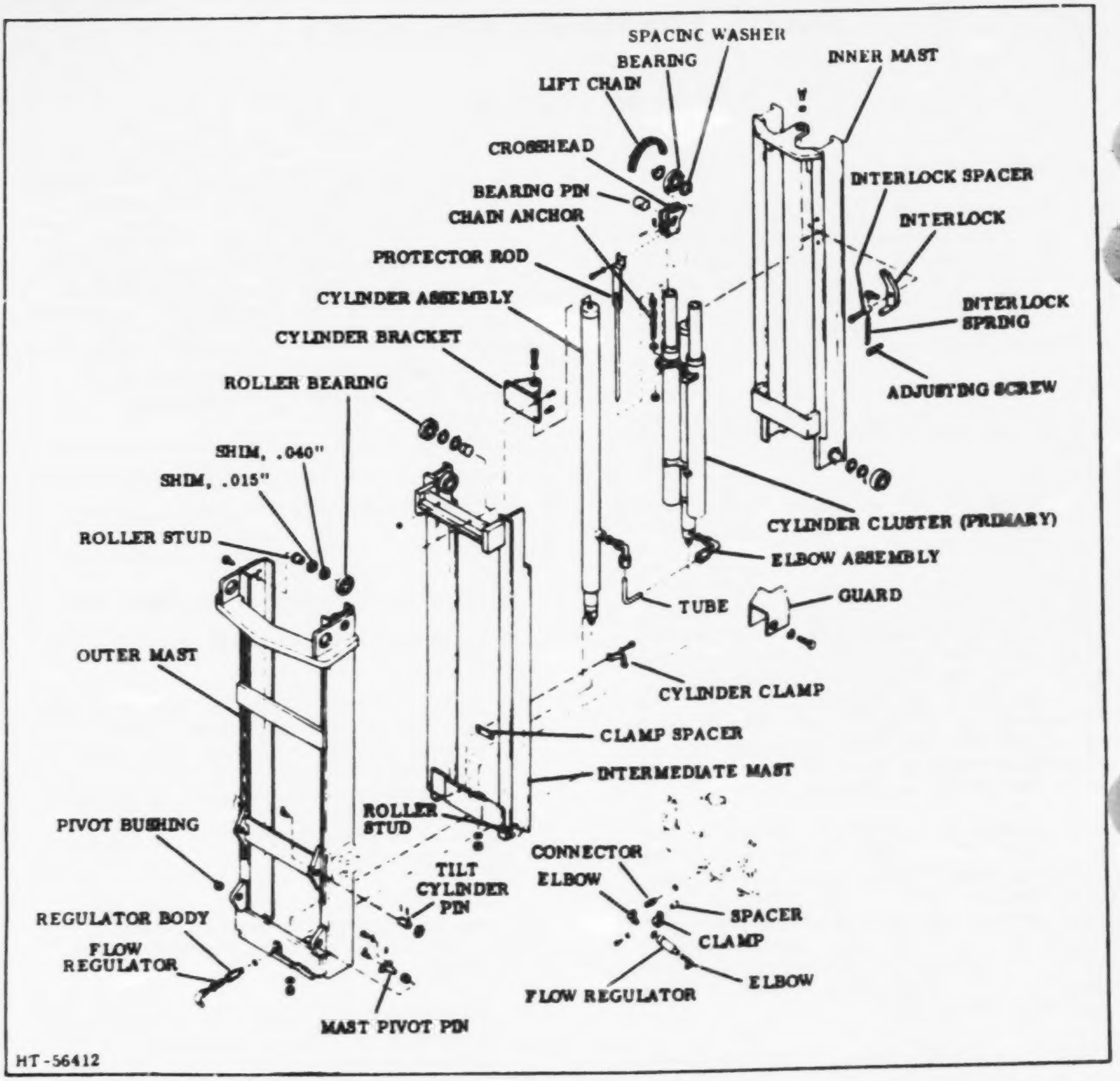

SPACING WASHER
BEARING
INNER MAST
LIFT CHAIN
CROSSHEAD
BEARING PIN
CHAIN ANCHOR
INTERLOCK SPACER
INTERLOCK
PROTECTOR ROD
CYLINDER ASSEMBLY
INTERLOCK SPRING
CYLINDER BRACKET
ADJUSTING SCREW
ROLLER BEARING
SHIM, .040"
SHIM, .015"
ROLLER STUD
CYLINDER CLUSTER (PRIMARY)
ELBOW ASSEMBLY
GUARD
TUBE
OUTER MAST
CYLINDER CLAMP
CLAMP SPACER
INTERMEDIATE MAST
ROLLER STUD
PIVOT BUSHING
CONNECTOR
TILT CYLINDER PIN
ELBOW
SPACER
REGULATOR BODY
CLAMP
FLOW REGULATOR
ELBOW
FLOW REGULATOR
MAST PIVOT PIN
HT-56412

Figure 1. Tri-Max Mast (Cluster Cylinders)

4. Remove the bearings and studs from the top of the outer mast.

5. Remove the bearings and shims from the studs remaining on the mast sections.

6. Clean all parts with an acceptable solvent.

7. Carefully inspect all parts for evidence of wear or damage, and replace any worn or badly damaged parts.

8. In the event of any bearing failure where the inner race has been fractured, carefully examine the respective bearing stud for nicks. Replace any studs with nicks or other evidence of damage.

9. It is recommended that whenever a stud or bearing that is mounted with a screw or capscrew has been replaced, that the screw or capscrew be replaced too.

10. Repair cracks and minor breaks by welding, if practicable.

D. TRI-MAX MAST (CLUSTER CYLINDER) REASSEMBLY

1. Carefully insert the inner mast section within the intermediate mast section.

NOTE: Ensure that all roller bearings have been replaced, and are shimmed if necessary.

2. Carefully insert the inner/intermediate mast sections within the outer mast section; this is accomplished by reversing the removal procedure, that is, by inserting mast sections at the top of the outer mast.
3. Replace the channel restraint interlock assembly. Replace the cylinder bracket at the intermediate mast top support.
4. Install the cluster cylinder assembly and the intermediate cylinder assembly (refer to TRI-MAX CYLINDER CLUSTER INSTALLATION for specific instructions).
5. Replace the bearings and studs previously removed from the top of the outer mast.

E. INSTALLATION

1. Using a properly rated hoist, maneuver the mast assembly into its relative mounting position on front of the lift truck.
2. Carefully insert the mast pivot pins by reversing the REMOVAL procedure.
3. Connect and properly secure the tilt cylinders.
4. Replace hydraulic line(s).
5. Refer to CARRIAGE ASSEMBLY, Topic 3, and install carriage.
6. If applicable, replace capscrews and spacer at carriage roller supports.
7. Replace carriage forks. (Refer to FORK INSTALLATION, Topic 4.)

F. LIFT CHAIN ADJUSTMENT

When it becomes apparent that the fork carriage is not level, that the lift chains are loose, or that the forks are higher than 1/4" to 1/2" above the floor when the lift cylinder is fully lowered, then the lift chains require adjustment.

Although the chain anchors are of different sizes and in different locations on the various types of masts, the lift chain adjustment remains the same, with the following exception:

NOTE: ALL CLUSTER CYLINDERS are adjusted with the PRIMARY Cylinder FULLY extended.

1. Position the mast assembly so it is vertical. Ensure that the inner mast section and lift cylinder are in the fully lowered position.
2. Loosen the chain anchor locknuts.
3. Chain tension is adjusted by increasing or decreasing the chain lengths with the adjusting nuts. Alternately tighten or loosen the chain on one side and then on the opposite side, until the chains are snug, with no slack, and carriage forks clear the floor within 1/4" to 1/2".

NOTE: Two (2) sets of chains are used in TRI-LIFT (and some TRI-MAX) masts, and chain tension is adjusted with adjusting nuts and turnbuckles. Adjust primary chain anchors first until forks barely clear the floor. Then adjust the secondary chain anchors until chains are snug.

4. Make certain that the lift chain tension is equal on each chain and that the fork carriage is level.

5. After the adjustment is completed, tighten the locknuts securely and make certain adjustments were not turned.

G. BEARING ADJUSTMENT (TRI-MAX MAST)

1. Outer Mast Assembly. Use an adjustable inside spanning tool and check the rear inside of the outer mast upright to find narrowest distance between uprights. Lock tool in this position. Set an adjustable outside spanning tool to match inside spanning tool. Lock tool in this position.

2. Intermediate Mast Assembly. Install bearings on studs located at bottom of intermediate mast assembly. Use an outside spanning tool as set in Step 1 above and span bearings at maximum camber point. Shim bearings, if required, to obtain maximum .015 inch clearance between bearings and outside spanning tool. Divide shims as equally as possible between bearings. Shims are available in 0.015 and 0.040 inch thicknesses.

> NOTE: If odd shim is required, place odd shims on same side of all mast sections and carriage so mast will be in balance.

3. Outer Mast Assembly Top Bearing. Use outside spanning tool and find widest point in outside width of web on intermediate mast assembly. Install bearings on studs at top inside of outer mast. Use inside spanning tool to span bearings at maximum camber point. Check clearance between outer and inner spanning tools. Measure clearance accurately and install shims to provide proper clearance. Install shims as equally as possible under both bearings to provide maximum .015 inch clearance.

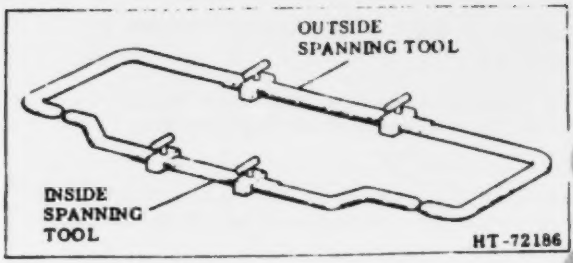


Figure 2. Setting Outside Spanning Tool

4. Inner and Intermediate Mast Bearings. Perform Steps 2 and 3 to adjust upper bearings on inside of intermediate mast and lower bearings on inner mast.

5. Carriage Assembly Bearings. Use inside spanning tool and check inside of web of inner mast assembly and determine narrowest point. Set outside spanning tool to match inside spanning tool. Lock tool in position. Install bearings on roller studs on carriage. Span bearings on carriage assembly at the maximum camber point with outside spanning tool. Span all three sets of bearings. Shim bearings to produce maximum .015 inch clearance with spanning tool. To check bearing alignment, place a straightedge against stud centerline to all three bearings on both sides of carriage assembly. No visible gap should be seen between bearings and the straightedge.

6. After assembly raise and lower the mast and carriage several times to check for free movement throughout the entire range of travel.

TOPIC 2. LIFT CYLINDERS

A. DESCRIPTION

Various renderings of the lift cylinder mechanism are available depending on the type of mast assembly used on the lift truck. All lift cylinders operate by the same hydraulic principles regardless of their multiplicity or arrangement.

The hydraulic oil enters the lift cylinder(s) at, or near, the base of the cylinder(s) causing the plunger(s) to extend.

A flow regulator, which is located at the oil inlet port of the lift cylinder(s), controls the flow of hydraulic oil so that the load lowers at a controlled rate of speed from the raised position.

B. SERVICE

After each 50 hours of operation, inspect the mast lift cylinder(s), cylinder hoses and fittings for evidence of leaks and repair as necessary.

The following procedures are recommended for the proper removal of the respective lift cylinders noted:

C. TRI-MAX LIFT CYLINDERS (CLUSTER TYPE) REMOVAL

1. Disconnect the lift chains from adjusting screws on the cylinder cluster.

2. With cylinders completely collapsed, disconnect the hydraulic line between the cluster cylinder and the single cylinder.

3. Remove the screw and nut which secure the cylinder cluster to the inner and intermediate masts.

4. Carefully lift cylinder cluster from the mast assembly.

   Remove the crosshead assemblies and ram guards from the outer cylinder rams.

5. To remove the single lift cylinder, remove the fittings, clamps and the flow regulator from the cylinder.

6. Remove the clamp securing the lift cylinder to the intermediate mast. Remove the screw and washer securing cylinder to bracket at top of intermediate mast. Remove nut and washer securing cylinder to bottom of outer mast.

7. Remove the single cylinder from the mast and place it on appropriate supports to prevent its rolling during inspection and repair work.

D. TRI-MAX AND HIGH-FREE LIFT (CLUSTER TYPE) DISASSEMBLY AND INSPECTION

1. Remove the gland nut from the tube of cylinder with a spanner wrench, then remove the wiper ring, back-up ring, "O" ring, packing and nylon pellets from the gland nut.

2. remove the STOP RING from the tube, if applicable. (Note: Stop ring not used on all clusters and single cylinders.)

3. Carefully slide the ram from the tube and remove the wear ring from the ram.

CAUTION: Always use care when handling the ram assembly so that it will not be nicked or damaged.

4. Clean all metal parts with an acceptable solvent. Inspect parts for wear or damage.

5. Remove any nicks and scratches with fine emery paper or honing stone; replace all unserviceable parts.

NOTE: Always replace all packing sets, "O" rings, back-up rings, and wiper rings, regardless of their condition. Be certain shell is clean and free of foreign matter.

NOTE: Disassemble and repair remaining cylinders in same manner.

6. The single cylinder of the Tri-Max cluster arrangement is serviced in the identical manner as the cluster cylinder.

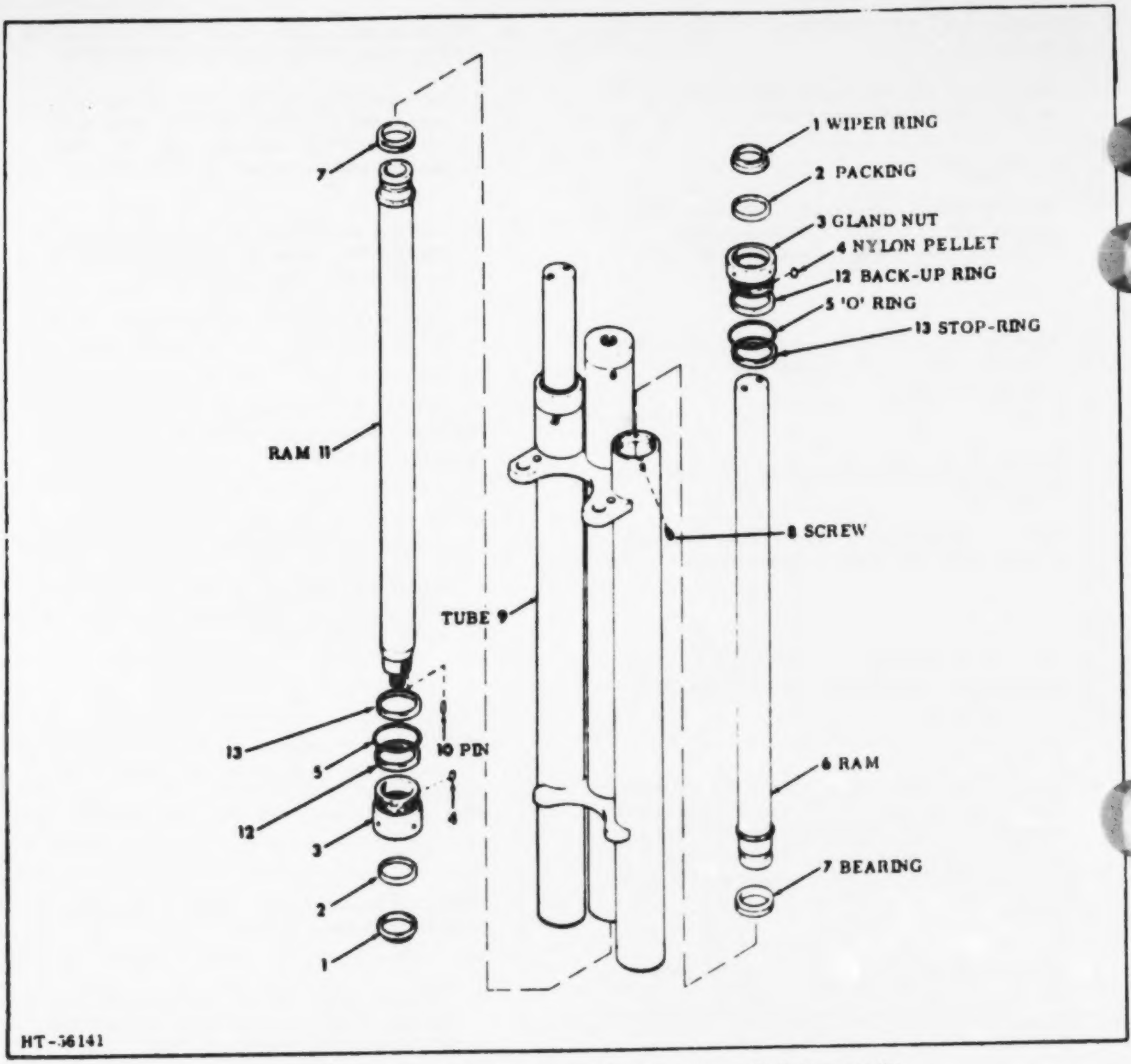

1 WIPER RING
2 PACKING
3 GLAND NUT
4 NYLON PELLET
12 BACK-UP RING
5 'O' RING
13 STOP-RING
7
RAM 11
8 SCREW
TUBE 9
13
10 PIN
5
12
3
4
6 RAM
7 BEARING
2
1
HT-36141

Figure 3. Cylinder Cluster Assembly (Tri-Max, High Free Lift)

E. TRI-MAX AND HIGH FREE LIFT CYLINDERS (CLUSTER TYPE) REASSEMBLY

1. Refer to Figure 3 and place bearing (7) on ram (6) end as shown.

2. Ensure that all parts and ram are free of any foreign matter and insert ram in tube (9) as shown. Install and tighten the stop ring (13), if applicable.

3. Preassemble packing (2) and wiper ring (1) within gland nut (3); then place "O" ring (5) and back-up ring (12) on gland nut (3). Insert replacement nylon pellets (4) in nut.

4. Slide preassembled gland nut (3) over ram (6), and using a spanner wrench, tighten gland nut into tube (9).

NOTE: Use same reassembly procedure on remaining rams and on the single cylinder, (Tri-Max only). Ensure that all parts are clean and free of foreign matter and that rams move smoothly without binding.

F. TRI-MAX AND HIGH FREE LIFT CYLINDERS (CLUSTER TYPE) INSTALLATION

CAUTION: Prior to lift cylinder installation, be certain that all parts are clean and that there is no foreign matter in the shell assembly.

1. Attach a properly rated hoist chain to the intermediate mast (TRI-MAX only), single lift cylinder, and carefully maneuver the cylinder into its relative mounting location.
2. Install and secure the washer and nut which attach the single cylinder to the bottom of the outer mast assembly (TRI-MAX only). Install and secure the washer and screw which attach cylinder to bracket at top of intermediate mast assembly. Remove hoist chain from cylinder after the intermediate mast retaining clamp has been replaced.
3. Replace all fittings and clamps previously removed from cylinder, and install the flow regulator.
4. To install the cylinder cluster assembly, first ensure that the crosshead assemblies have been correctly installed at the outer cylinder rams, and that the chain adjusting screws and locknuts have been installed.
5. Attach a properly rated hoist chain to the cylinder cluster assembly and maneuver cluster assembly into its relative mounting position within the inner and outer masts.
6. Install the attaching capscrews which secure the cylinder cluster to the inner and intermediate masts (outer mast, HIGH-FREE LIFT). Tighten mounting bolts.
7. Replace the chain guard and connect the hydraulic line between the cylinder cluster and the single cylinder (TRI-MAX only).
8. Install and reconnect the cylinder cluster lift chains at the cluster adjusting screws.

NOTE: Refer to CHAIN ADJUSTMENT in Topic 1, prior to operational use of lift truck.

9. Install carriage assembly. (Refer to CARRIAGE INSTALLATION Topic.)

MEMO

TOPIC 4. FORKS

A. DESCRIPTION

Basically, there are two types of lift forks; the shaft style which pivots on a horizontal support shaft, and the more commonly used hook style fork (Figure 5) which hooks into notches along the top edge of the fork carriage. The standard or hook type fork will be discussed here. Any differences will be noted in shaft type removal and installation.

The forks should always be adjusted on the carriage to obtain the optimum balance in proportion to the width of the anticipated loads.

A fork lock (Figure 6) is installed in the top of each of the hook type forks to hold it in position in one of the notches along the top bar of the carriage. To change the fork location, pull up on the lock and move fork to the left or right. Allow fork lock to seat in the notch nearest to location chosen.

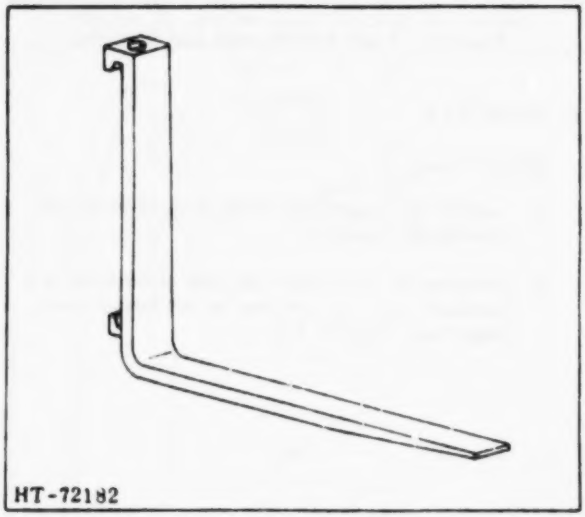


Figure 5. Hook Type Fork

The forks can be easily removed from the carriage by releasing the locks and aligning each fork with the wide removal slot (Figure 6) at the bottom of the fork carriage. (Refer to following REMOVAL procedures for detailed instructions.)

CAUTION: Naturally, the weight of each fork depends upon its size. Therefore, exercise caution while fork is being removed from the carriage to avoid injury to personnel and to prevent damage to the equipment.

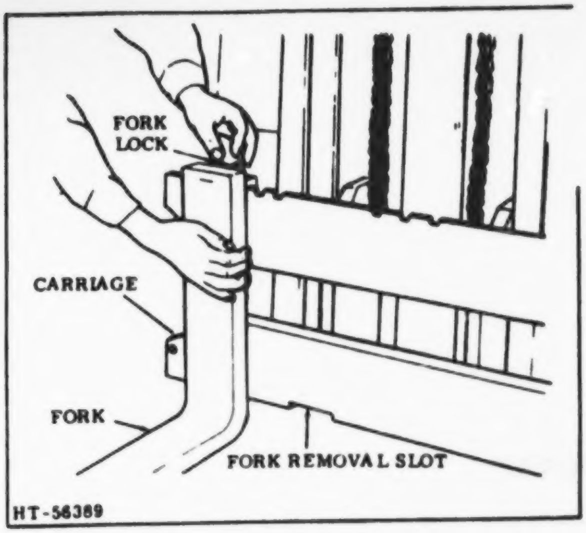


Figure 6. Fork Adjustment and Removal

B. REMOVAL

(Hook Type)

1. Lower fork carriage until base of fork just clears the floor.
2. Release the fork lock pin and slide fork to a position over the cut-out in the lower carriage bar (Figure 6).
3. Tilt the lower portion of the fork forward and up, releasing the lower hanger from the lower carriage bar.
4. Refer to cautionary note in Paragraph A above, and lift fork off upper carriage bar.

C. SERVICE

1. Inspect hook fork and locking mechanism for any evidence of wear or damage.
2. If locking mechanism is worn or damaged, remove and replace it as a unit.
3. If fork is defective, then replace with same type and capacity rated fork.

D. INSTALLATION

(Hook Type)

1. Carefully lift fork up onto upper carriage mounting slot, then slowly lower until back of fork rests against carriage face and bottom fork hook passes through lower carriage cut-out.
2. Release the fork lock pin and slide fork left or right until properly positioned for anticipated load clearance/balance requirements.

TOPIC 5. WELDING REPAIR PROCEDURE

For various applications in the mast and carriage assemblies, specially treated metals are used. Care must be taken when these metals are repaired or replaced by welding. Figures 22 thru 24 illustrate the manner in which the welding is to be performed.

Prepare welding surface by removing all foreign material such as rust, scale, grease, etc. Any part that may be damaged by heat should be removed before welding.

After welding is completed, remove all slag, weld spatter and excessive weld material.

A. REPAIR WELDING CARRIAGE AND MAST ROLLER STUDS

Process	Shielded Metal Arc
Equipment	Manual
Settings:	
Current	A.C.
Amps	275/325
Volts	31/33
Base Metals	(1) AC 1035-P1 (2) AC 86-L-20-H (roller stud)
Plate Thickness Range	3/8" - 1"
Electrode:	
Type	Stick
Class	E 7018 (hydrogen free)
Size	3/16"
Flux	Electrode Covering
Weld Type and Size	1/4" Fillet
Number of Passes	1
Position	Horizontal
Preheat	400°F
Interpass	250°F
Postheat	None

B. INSPECTION

1. Finished weld to be magnafluxed for defects.
2. The weld defect shall be explored by removing material with a pencil grinder in 0.010" - 0.020" deep passes (length to depth ratio of 4:1). Visually inspect for defect after each pass and magnaflux to confirm disappearance.

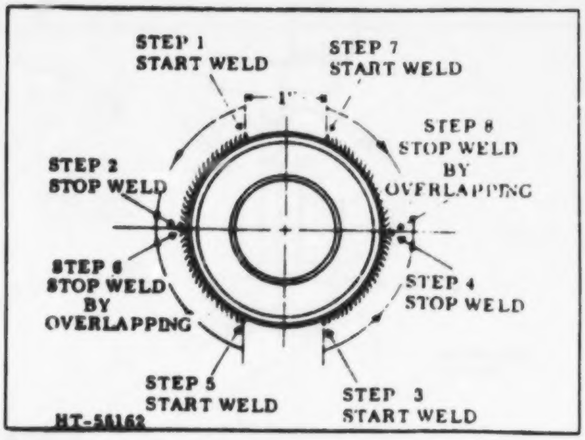

STEP 1
START WELD
STEP 7
START WELD
1"
STEP 8
STOP WELD
BY
OVERLAPPING
STEP 2
STOP WELD
STEP 6
STOP WELD
BY
OVERLAPPING
STEP 4
STOP WELD
STEP 5
START WELD
STEP 3
START WELD
HT-58162

Figure 22. Roller Stud Welding Procedure

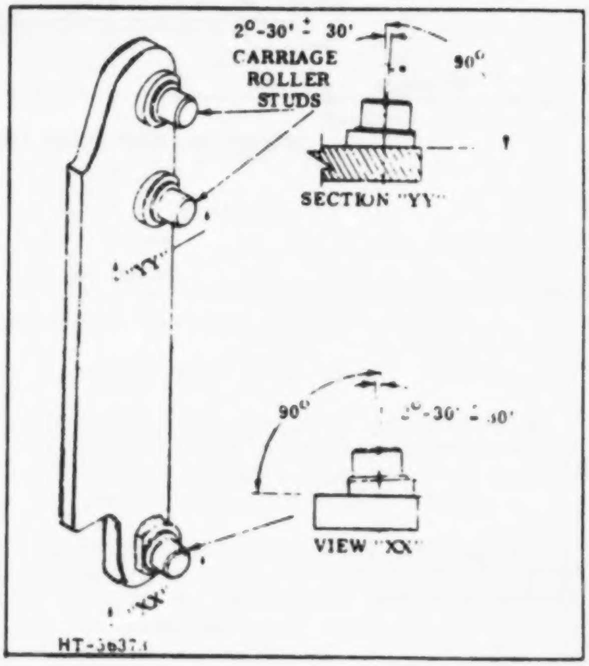

2°-30' ± 30'
CARRIAGE
ROLLER
STUDS
90°
SECTION "YY"
"YY"
90°
2°-30' ± 30'
VIEW "XX"
"XX"
HT-56373

Figure 23. Carriage Roller Stud Location (Canted Roller Type)

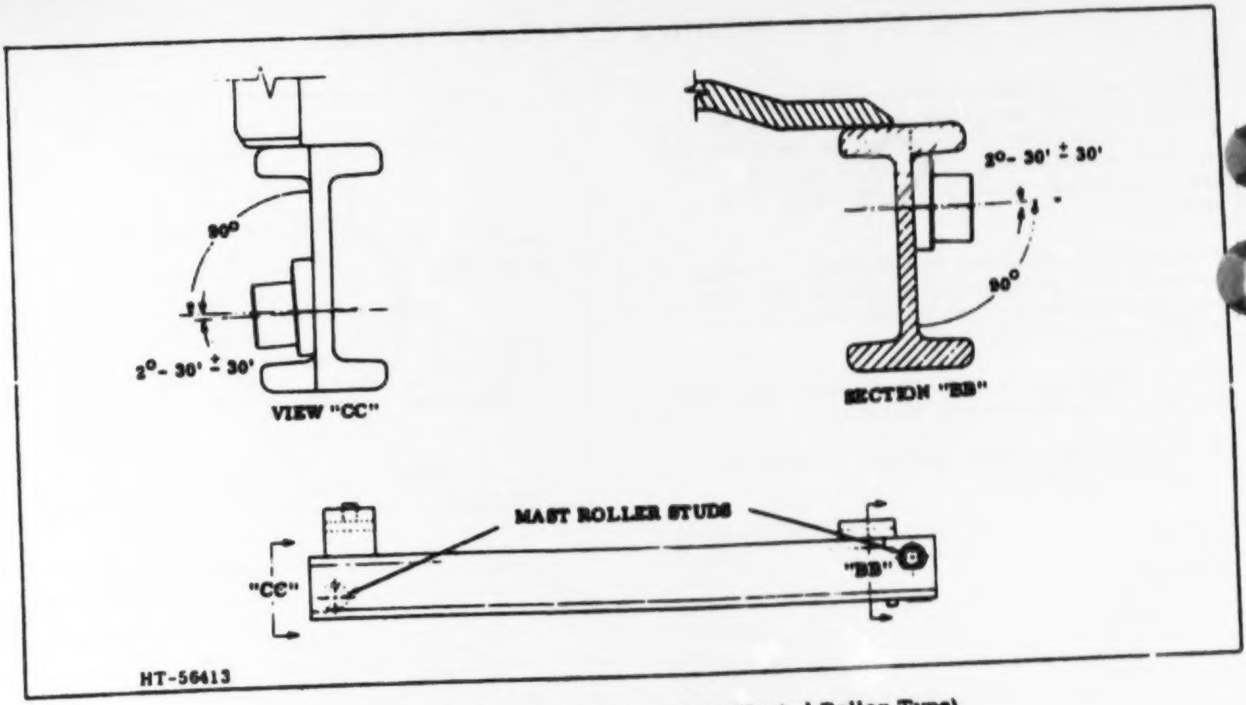

90°
2°- 30' ± 30'
VIEW "CC"
2°- 30' ± 30'
90°
SECTION "BB"
MAST ROLLER STUDS
"CC"
"BB"
HT-56413

Figure 24. Mast Roller Stud Location (Canted Roller Type)

TOPIC 5.SIDE SHIFTERS

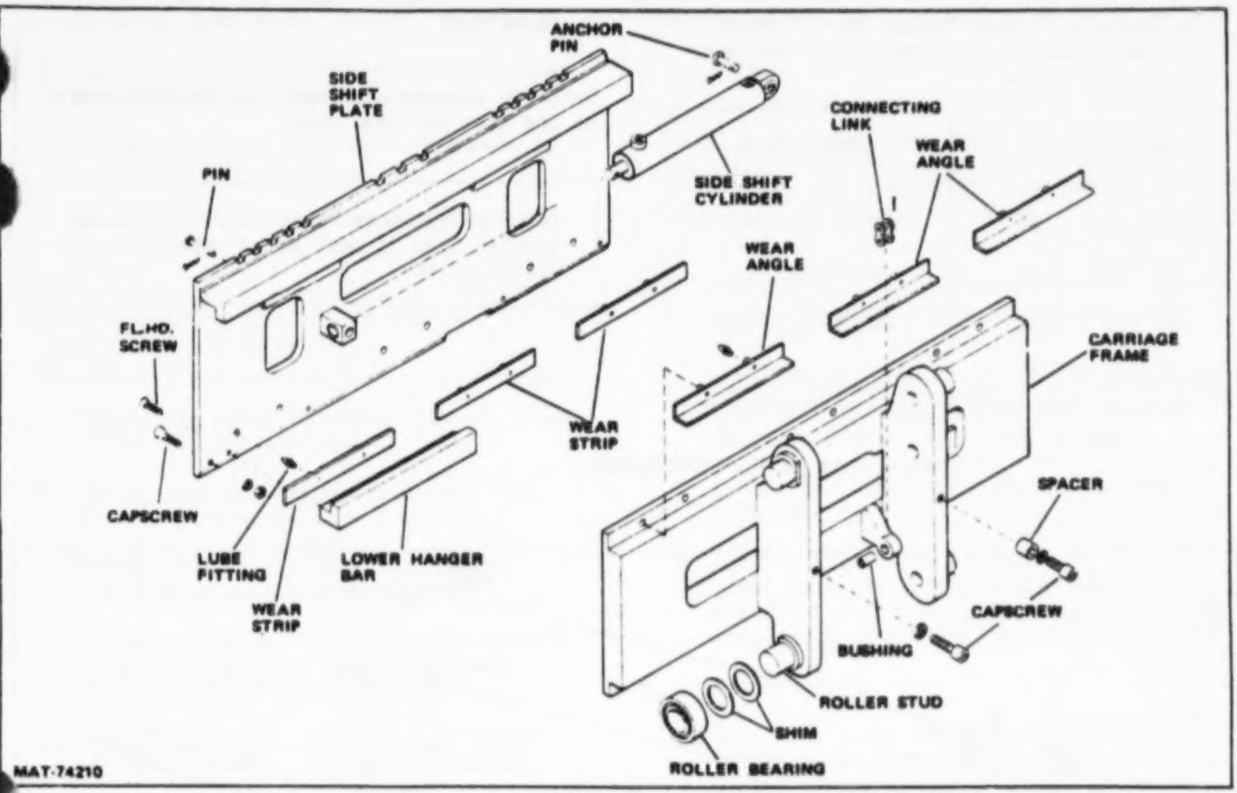

ANCHOR PIN
SIDE SHIFT PLATE
CONNECTING LINK
WEAR ANGLE
PIN
SIDE SHIFT CYLINDER
WEAR ANGLE
FL.HD. SCREW
CARRIAGE FRAME
WEAR STRIP
SPACER
CAPSCREW
LUBE FITTING
LOWER HANGER BAR
WEAR STRIP
CAPSCREW
BUSHING
ROLLER STUD
SHIM
ROLLER BEARING
MAT-74210

Figure 7. Side Shifter Components (Typical)

A. REMOVAL/INSTALLATION

First disconnect hydraulic hoses at junction block on carriage frame, then refer to TOPIC 1 and perform the appropriate removal (or installation) procedures.

B. DISASSEMBLY

NOTE: For disassembly of the carriage frame refer to the appropriate topic depending on the type carriage used.

1. To disassemble side shifter, first disconnect and plug the hydraulic hoses from the side shift cylinder, to prevent entry of foreign particles.
2. Disconnect side shift cylinder from side shift plate by removing retaining pin and cotter pin.
3. Attach a suitable hoist to side shift plate and take up slack in chain.
4. Slide side shift plate off right side of carriage frame (when facing the carriage), and move to desired location.
5. Remove lower hanger bars.
6. Pry off wear strips at bottom of side shift and top of carriage plates. Wear strips and wear angles should be replaced when worn to a thickness of .063".
7. Check all wear strip and wear angle mating surfaces for nicks, foreign material or any high spots. Repair or replace as necessary.

C. REASSEMBLY

1. Reinstall wear strips and wear angles by snapping into holes provided. Lubricate all wear strips and angles with a light coat of a Grade 2 lithium base grease, (characterized by the word "Moly").
2. Using a suitable hoist, lift side shift plate to relative mounting position at right side of carriage frame (when facing carriage).
3. Carefully slide side shift plate onto carriage frame.
4. Reconnect side shift cylinder plunger to side shift plate by reinstalling retaining

pin and cotter pin.

5. Reconnect hydraulic hoses to cylinder.

6. Reinstall lower hanger bars. Torque capscrews to required value; see tabulation below.

CAPSCREW SIZE	TORQUE VALUE
.38"-16 x 1.25"	28-33 lb. ft.
.38"-16 x 1.50"	28-33 lb. ft.
.50"-13 x 1.50"	68-73 lb. ft.
.63"-11 x 1.75"	125-135 lb. ft.

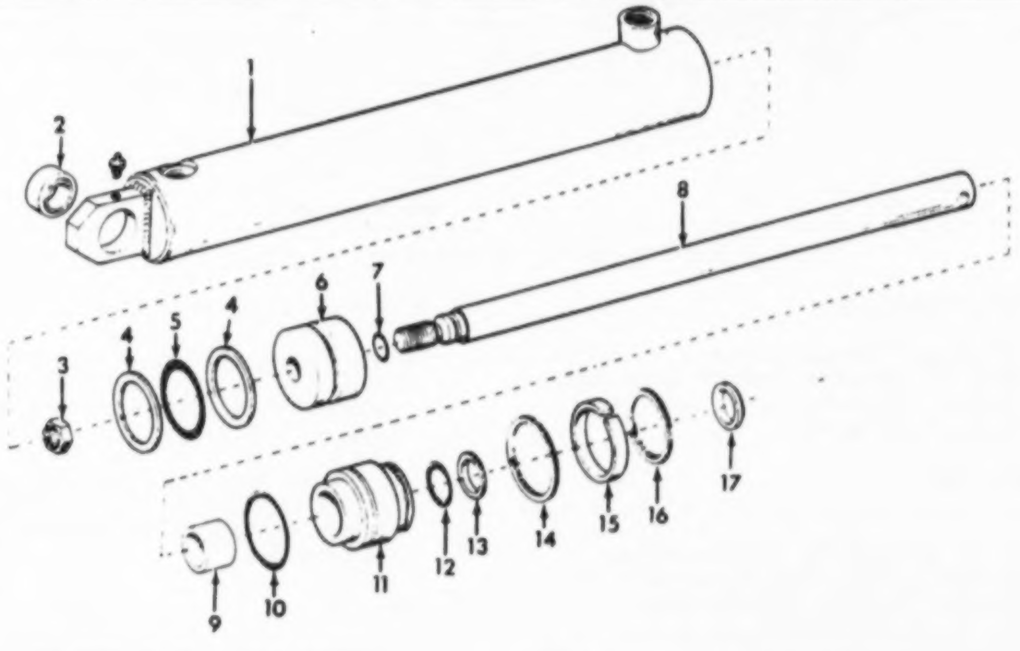
7. Lubricate all pressure lube fittings on side shifter unit.

D. ADJUSTMENT

Refer to appropriate Topic for the adjustment of the type carriage used.

NOTE: If carriage frame is of the canted bearing type it must be adjusted before installation.

TOPIC 6. SIDE SHIFTER CYLINDER



1. TUBE ASSEMBLY
2. BUSHING
3. JAM NUT
4. BACK-UP WASHERS
5. "O" RING
6. PISTON
7. ROD SEAL
8. ROD
9. BUSHING
10. HEAD SEAL
11. HEAD
12. "O" RING
13. BACK-UP WASHER
14. LOCK RING
15. SPACER
16. LOCK RING
17. ROD WIPER

721066-52596-2

Figure 8.

A. REMOVAL

1. Remove cotter pin and rod pin from cylinder rod.

2. Retract cylinder rod far enough to clear rod retainer on side shift plate.

3. Disconnect hydraulic hoses from cylinde Plug cylinder ports and hydraulic hose ends to prevent entry of foreign material.

4. Remove cotter pin and cylinder retainer pin and lift out cylinder.

B. DISASSEMBLY

1. Remove lock ring securing spacer in position then remove spacer.
2. Compress lock ring holding head to tube and remove from cylinder.
3. Remove remaining internal components by careuflly pulling on rod.
4. Carefully slide head off end of rod.

> NOTE: Ensure that rod is free of any burrs which may damage bushing in head while removing head from rod.

5. Remove nut securing piston to rod. Slide piston off end of rod.
6. Remove back-up washer and O-Ring from piston. Remove rod seal from rod.
7. Remove head seal, lock ring, O-Ring and back-up washer from head.
8. Old head bushing may be pressed out with a new bushing after head is cleaned. Refer to PARAGRAPH D, ASSEMBLY.
9. Check bushing and lube fitting at end of tube assembly, if damaged replace.

. INSPECTION

Inspect tube bore, rod head, and piston for cracks, scratches, scoring and other possible damage. Repair or replace any components that are worn or damaged.

D. REASSEMBLY

Clean all components in an approved solvent making certain all dirt and contaminants are removed. Prior to assembling, coat each component with clean hydraulic oil to facilitate installation and to provide initial lubrication.

1. Install rod seal on rod.

> NOTE: When installing seals and O-Rings, be careful not to damage them on threads or sharp edges. Always use new O-Rings whenever cylinder is serviced

2. Position back-up washer and O-Ring within piston. Install piston on rod and secure with nut.
3. Install O-Ring and back-up washer in head. Position head seal, large lock ring, spacer and small lock ring on head.
4. Carefully slide piston and rod assembly into tube.
5. Position head assembly over rod and compress large lock ring. Slide head assembly (with lock ring compressed) into tube until lock ring snaps into groove in tube.

E. INSTALLATION

1. Insert cylinder end with self-aligning bearing into anchor on carriage plate. Secure with retainer pin and new cotter pin.
2. Connect hydraulic hoses to cylinder.
3. Connect cylinder plunger to side shift plate after plate has been installed. (Refer to TOPIC 6, PARAGRAPH C).
4. Lubricate pressure lube fitting on cylinder.

HOSE REEL

A. INSTALLATION

1. The hose reel must be installed in such a manner as to eliminate any interference when mast is tilted all the way back. Reel should be mounted so that inner flange is as close as possible to mast channel (maximum 1/4" clearance) so as to keep reel within the overall width of the truck.

2. The junction block must be installed on the center line of the middle divider of the hose reel. This permits hoses to wind properly.

3. Install the hoses to the hose reel and wrap hoses around reel. Raise the lift truck carriage until the junction block is even with the hose reel. Turn hose reel three complete turns by pulling on hose. This provides proper tension on hose. Hold hose securely and wrap hose back around reel and connect to junction block.

4. Raise and lower lift truck carriage and check reel for proper winding of hose. It may be necessary to twist hose slightly to get hose to wind properly.

B. SERVICE

Hose reel can be serviced either on or off the lift truck.

1. Raise carriage until junction block is even with hose reel. Disconnect hose.

CAUTION: Hold onto reel and allow it to turn slowly until spring tension is relieved.

2. Remove four nuts and lockwashers holding spring can in place. With one hand, pull spring can slowly away from flange, slide other hand between spring can and the flange to prevent spring from jumping out of can. Slide can from shaft and place it over a pan to allow any excess oil to drain.

3. Remove snap ring and slide flange assembly from shaft. O-rings and back-up rings are now exposed for replacement. O-rings and back-up rings must be replaced in a set.

4. Thoroughly lubricate o-rings and back-up rings with hydraulic oil before installing hub and flange assembly. When installing the flange assembly back onto the shaft, use a rotary motion while pushing flange assembly onto shaft. This will reduce chance of nicking o-ring.

5. Replace snap ring on shaft.

6. If spring assembly is dry, or needs additional lubrication, apply small amount of Molygrease to spring.

7. Slide spring can onto shaft. Be sure spring enters slot on radiused side. Secure spring can in place with four nuts and lockwashers.

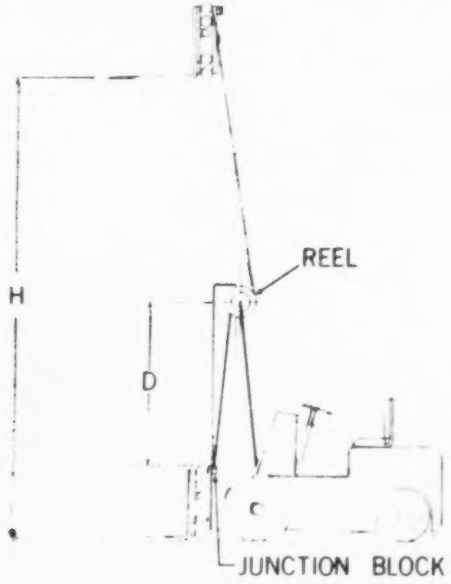


Figure 1. Hose Length Calculation

8. Rewind hose and repeat steps 3 and 4 in INSTALLATION instructions.

> NOTE: It is necessary that 32" of hose be pre-wrapped on reel and that reel spring be pre-loaded to proper tension.

C. HOSE LENGTHS

he following formula will assist in calculating hose lengths.

H = Total lift height.

D = Distance from center line of reel to junction block in collapsed upright position.

1. When "H" is equal to, or greater than, 2 "D" then length = "H"-"D" + 32".
2. When "H" is less than 2 "D", the hose length = "D" + 32.

Example: H = 100", D = 68"
100"-68" + 32" = 64" hose length.

This formula automatically will include 32" of pre-wrap in the hose length. This amount of pre-wrap is necessary to take stress off the hose fittings and also to assist in proper lay of hose during the winding operation.

MEMO

SECTION IV

PARTS LIST

NUMERICAL INDEX

The following numerical index lists all Allis-Chalmers 4 million series part numbers found in the parts list and their page numbers.

Supplier information is listed in the form of the Federal Manufacturer's Code number and that manufacturer's part number.

The following is a list of the Federal Manufacturer's Code numbers that appear in the index along with their names and addresses.

CODE	NAME AND ADDRESS	CODE	NAME AND ADDRESS
00624	Aeroquip Corp. Jackson, MI 49203	21634	Eaton Corp. Cleveland, OH 44104
01843	American Bosch Springfield, MA 01107	22031	Air Way Mfg. Co. Olivet, MI 49076
01862	Abex Corp. New York, NY 10036	27783	Scovill Mfg. Co. Dickson, TN 37055
02249	Gresen Mfg. Minneapolis, MN 55440	30327	Imperial Eastman Corp. Chicago, IL 60648
02660	Amphenol Corp. Broadview, IL 60153	30612	Allis Chalmers Matteson, IL 60443
04895	Lincoln Lubrication St. Louis, MO 63133	36540	Lisle Corp. Clarinda, IA 51632
08108	Lamp Industry Industry Designations	38443	Marlin-Rockwell Corp. Jamestown, NY 14701
09367	Allis Chalmers Eng. Div. Harvey, IL	45014	Orange Roller Brg. Co. Orange, NJ 07051
11671	Tyrone Hydraulics Corinth, MS 38834	49234	Protectoseal, Inc. Chicago, IL 60608
13445	Cole Hersee Boston, MA 02127	51588	Roller Brg. Co. Trenton, NJ 08628
14892	Bendix Corp. South Bend, IN 46619	52193	Foote Jones Div. Chicago, IL 60690
14894	Bendix Corp. South Bend, IN 46619	52676	SKF Ind. Inc. Philadelphia, PA 19132
15466	Monona Tube Inc. Madison, WI 53715	53591	Wallace-Murray Corp. Indianapolis, IN 46206
16764	Delco Remy Div. Anderson, IN 46011	57733	Stewart-Warner Corp. Chicago, IL 60614
18163	Dole Valve Co. Morton Grove, IL 60053	59730	Thomas and Betts Co. Elizabeth, NJ 07207
18265	Donaldson Mfg. Minneapolis, MN 55440	60038	Timken Roller Bearing Co. Canton, OH 44706
21103	Sparton Mfg. Co. West Flora, IL 62839	60380	Torrington Co. Torrington, CT 06790

CODE	NAME AND ADDRESS
63477	Wagner Electric Corp. St. Louis, MO 63133
64294	Webster Electric Co. Racine, WI 53403
66295	Wittek Mfg. Co. Chicago, IL 60623
67049	Young Radiator Co. Racine, WI 53403
70026	Chicago Fittings Corp. Broadview, IL 60153
70040	AC Spark Plug Div. Flint, MI 48556
70227	Ang Industries Mount Vernon, OH 43050
70434	Anchor Coupling Co. Libertyville, IL 60048
70485	Atlantic India Works Chicago, IL 60607
70797	Arco Industries Detroit, MI 48239
71400	Bussman Mfg. Div. St. Louis, MO 63017
72210	Columbus Auto Parts Co. Columbus, OH 43211
72530	Deluxe Products Corp. Racine, WI 53402
72625	Amsted Ind. Inc. Indianapolis, IN 46225
72962	Elastic Stop Nut Div. Union, NJ 07083
73047	Fairfield Mfg. Co. S. Lafayette, IN 49702
73370	Fram Corp. Providence, RI 02916
73740	Ross Gear Div. Lebanon, TX 37087
73842	Goodyear Tire and Rubber Co. Akron, OH 44316
73680	Garlock Ind. Palmyra, NY 14522
74400	Hobbs Div. Springfield, IL 62705
75272	Kickhaefer Mfg. Co. Grafton, WI 53024
75958	Borg Warner Corp. Detroit, MI 48212
76062	Marlin-Rockwell Jamestown, NY 14701
76110	Maremont Corp. Chicago, IL 60601
76260	Mechanics Div. Rockford, IL 61108
76474	Borg Warner Corp. Ithaca, NY 14850
77060	Packard Electric Div. Warren, OH 44481
77260	Pierce Governor Co. Upland, IN 46989
77447	Precision Spring Corp. Detroit, MI 48238
77640	Ross Gear Div. Lafayette, IN 47902
77890	Service Products Corp. Indianapolis, IN 46201
77915	Shellar Globe Corp. Portland, IN 47371
78553	Tinnerman Products Cleveland, OH 44129
79136	Waldes Kohinoor Long Island City, NY 11101
79410	Warner Gear Div. Muncie, IN 47305
79470	Weatherhead Co. Cleveland, OH 44108
80755	Randall Brg. Inc. Lima, OH 45802
81596	National Seal Div. Van Wert, OH 45891
82465	Mac Clean Fogg Co. Mundelein, IL 60060
84760	Standard Screw Co. Hartford, CT 06102
87946	Triangle Mfg. Co. Oshkosh, WI 54901

CODE	NAME AND ADDRESS
88044	Aeronautical Standards Dept. Silver Spring, MD
92392	Allis Chalmers Milwaukee, WI 53201
92687	National Electric Toledo, OH
92850	Anchor Ind. Inc. Cleveland, OH 44112
92863	Marvel Engineering Co. Chicago, IL 60614
93608	Standard Pressed Steel Co. Utica, MI 48087
93784	Husco Div. Waukesha, WI 53187
95879	Alemite Div. Chicago, IL 60614
96151	Char Lynn Co. Eden Prairie, MN 55343
96779	Rockwell Packing Co. Los Angeles, CA 90021
96906	Military Standards Military Departments
98121	Eaton Yale & Towne St. Louis, MO 63166

PART NO.	PAGE	VENDOR CODE	VENDOR PART NO.
C-2715	170	30612	
C-3552	170	30612	
C-3554	170	30612	
C-604032	171	30612	
C-645977	170	30612	
C-645982	170	30612	
C-645986	170	30612	
C-646036	171	30612	
C-646064	170	30612	
C-646075	170	30612	
C-646079	170	30612	
C-646246	170	30612	
C-646250	170	30612	
C-648569	170	30612	
C-649055	170	30612	
C-649106	170	30612	
C-7194	170	30612	
	171	30612	
C-7337	170	30612	
C-7912	170	30612	
C2715	171	30612	
C645978	170	30612	
C645989	170	30612	
C646081	170	02614	
C646340	171	02614	
C648569	171	30612	
0067766-6	75	79410	8107A
0080325-4	75	79410	4840F
0219977-6	41	96152	24-262
0219978-4	41	96152	24-340
0219987-5	41	96152	43-33
0219998-2	41	96152	24-340
0220000-4	41	96152	15-42
0222045-7	41	96152	15-285
0222069-7	41	96152	82-16
0226446-3	41	96152	44-68
0226447-1	41	96152	55-261
0226451-3	41	96152	15A85
0226452-1	41	96152	16A41
0226456-2	41	96152	30-739
0226457-0	41	96152	32-16
0226468-7	41	96152	49-514
0231321-1	59	16764	1939970
0233770-7	113	30612	
	137	30612	
0237006-2	55	16764	1941978
0237168-0	41	96152	29-552
0239168-8	41	96152	248831
0242826-6	55	16764	1971993
0242829-0	55	16764	1959991
0242838-1	55	16764	1956975

PART NO.	PAGE	VENDOR CODE	VENDOR PART NO.
0243792-6	55	30612	
0243855-4	59	16764	1923023
0246077-2	59	16764	1941113
0246098-8	59	16764	1926640
0251710-0	41	96152	14-273
0251726-6	41	96152	55A103
0252042-7	59	16764	1966923
0257091-9	41	96152	25-214
0257092-7	41	96152	44-166
0262167-0	55	16764	1894559
0262168-8	55	16764	1894586
0262169-6	55	16764	436700
0262170-4	55	16764	1894568
0632465-1	93	60038	M88048
0632466-9	93	60038	M88010
0800465-7	41	96152	80-171
0900537-2	149	30612	
0900576-0	149	30612	
0901043-0	66	30612	
0901228-7	59	16764	9413260
0901502-5	67	30612	
0901504-1	67	30612	
0901652-8	39	30612	
0901653-6	131	30612	
0901677-5	39	96906	MS51845-7
0901826-8	83	96906	MS51887-3
0903625-2	67	96906	MS90725-6
0903626-0	67	75272	TC79
0904204-5	67	96906	MS35338-44
0904709-3	39	30612	
0910005-8	1	02978	X02279
0910007-4	1	02978	X02202
	75	79410	117923
	109	79410	117923
0910014-0	1	02978	X02236
0910140-3	39	79470	49X5X4
0910371-4	41	96152	81-1
0910847-3	109	30612	
0910941-4	17	02978	X002028
	19	02978	X00208
	19	02978	X002028
	29	02978	X00202B
0910978-6	75	79410	118755
0910995-0	39	79470	42X5
0911406-7	151	30612	
0911421-6	67	30612	
0911987-6	51	96906	MS27183-13
0912264-9	102	30612	
0912279-7	165	96906	MS16995-97
0912319-1	1	30327	201E
0912808-3	85	96906	MS15004-1

PART NO.	PAGE	VENDOR CODE	VENDOR PART NO.
0913107-9	67	96906	MS35335-41
0913599-7	95	27995	03-02-102-10
0913744-9	66	30612	
	85	96906	MS35691-34
	109	96906	MS35691-34
	165	96906	MS51967-14
0914192-0	33	96906	MS51968-2
0914383-5	1	02978	X05705
0914453-6	31	30327	200E
0914687-9	165	95879	1792B
	165	95879	1792B
0914965-0	99	95879	1610B
0915275-2	109	96906	MS15003-5
0915276-0	151	95879	1613B
0915399-0	31	79470	3400X2
	39	79740	3400X2
0915538-3	109	95879	3041B
0915661-3	67	30612	
0915771-0	79	79410	147485
0915797-5	137	30612	
0915809-8	19	02978	X03777
	27	96906	MS90725-32
	79	79410	179816
0915815-5	123	30612	
	125	30612	
0915898-1	65	96906	MS45904-77
0916004-5	85	30612	
0916080-5	59	96906	MS353206-263
	147	30612	
0916081-3	65	96906	MS35206-263
0916169-6	51	30612	
	102	30612	
0916272-4	27	02978	X00203
0916356-8	125	96906	MS35338-46
0916532-5	155	30612	
0916602-6	39	96906	MS51968-8
	105	96906	MS35690-64
0916621-6	59	96906	MS35649-202
	65	30612	
	147	96906	MS35649-202
0916622-4	51	96906	MS51967-2
	51	96906	MS51967-2
	51	96906	MS51967-2
	65	96906	MS51967-2
	69	96906	MS51967-2
	155	96906	MS51967-2
	155	96906	MS51967-2
0916711-5	93	30612	
0916713-1	157	30612	
	159	30612	
0916735-4	27	02978	X12191
0916803-0	13	96906	MS35333-42
	97	96906	MS35333-42
	120	96906	MS35332-42
0916950-9	51	96906	MS51967-8
	53	96906	MS51967-8
	61	96906	MS51967-8
	99	96906	MS51967-8
	113	96906	MS51967-8
	113	96906	MS51967-8
	113	96906	MS51967-8
	115	96906	MS51967-8
	123	96906	MS51967-8
	137	96906	MS51967-8
	137	96906	MS51967-8
	137	96906	MS51967-8
	147	96906	MS51967-8
	153	96906	MS51967-8
	153	96906	MS51967-8
	155	96906	MS51967-8
	155	96906	MS51967-8
	155	96906	MS51967-8
	155	96906	MS51967-8
0916951-7	145	96906	MS51967-14
	145	96906	MS51967-14
	168	96906	MS51967-14
0916954-1	25	02978	X18067
	25	02978	X18067
	35	96906	MS51967-8
0916956-6	135	30612	
0916964-0	51	96906	MS35338-44
	51	96906	MS51967-8
	65	96906	MS35338-44
	69	96906	MS35338-44
	89	96906	MS35338-44
	91	96906	MS35338-44
	113	96906	MS35338-44
	113	96906	MS35338-44
	155	96906	MS35338-44
	155	96906	MS35338-44
0916965-7	23	02978	X00203
	27	02978	X00203
	31	96906	MS35338-46
	33	02978	X00203
	35	96906	MS35338-46
	39	96906	MS35338-46
	39	96906	MS35338-46
	51	96906	MS35338-46
	51	96906	MS35338-46
	53	96906	MS35338-46
	53	96906	MS35338-46
	57	96906	MS35338-46

PART NO.	PAGE	VENDOR CODE	VENDOR PART NO.
	61	96906	MS35338-46
	71	96906	MS35338-46
	91	96906	MS35338-46
	97	96906	MS35338-46
	99	96906	MS35338-46
	99	96906	MS35338-46
	102	96906	MS35338-46
	113	96906	MS35338-46
	113	96906	MS35338-46
	113	96906	MS35338-46
	113	96906	MS35338-46
	115	96906	MS35338-46
	123	96906	MS35338-46
	131	30612	
	135	96906	MS35338-46
	137	96906	MS35338-46
	137	96906	MS35338-46
	147	96906	MS35338-46
	151	96906	MS35338-46
	153	96906	MS35338-46
	153	96906	MS35338-46
	155	96906	MS35338-46
	155	96906	MS35338-46
	155	96906	MS35338-46
	155	96906	MS35338-46
	157	96906	MS35338-46
	159	96906	MS35338-46
0916966-5	37	96906	MS35338-48
	109	96906	MS35338-48
	125	96906	MS35338-48
	125	96906	MS35338-48
	127	96906	MS35338-48
	135	96906	MS353388-48
	145	96906	MS35338-48
	145	96906	MS35338-48
	168	96906	MS35338-48
	169	96906	M35338-48
	169	96906	MS35338-48
0917023-4	95	96906	MS16556-48
0917032-5	1	79470	3200X2
0917146-3	75	79410	423595
0917258-6	35	96906	MS51969-3
0917264-2	23	02978	X14134
0917356-8	27	96906	MS35338-45
	39	96906	MS35338-45
	39	96906	MS35338-45
	47	96906	MS35338-45
	53	96906	MS35338-45
	59	96906	MS35338-45
	61	96906	MS35338-45
	65	96906	MS35338-46

PART NO.	PAGE	VENDOR CODE	VENDOR PART NO.
	66	96906	MS35338-45
	75	79410	103320
	79	96906	MS35338-43
	83	96906	MS35338-45
	83	96906	MS35338-45
	85	96906	MS35338-45
	89	96906	MS35338-45
	89	96906	MS35338-45
	91	96906	MS35338-45
	91	96906	MS35338-45
	93	96906	MS35338-45
	93	96906	MS35338-45
	99	96906	MS35338-45
	102	96906	MS35338-45
	105	96906	MS35338-45
	105	96906	MS35338-45
	105	96906	MS35338-45
	113	96906	MS35338-45
	125	96906	MS35338-45
	147	96906	MS35338-45
	149	96906	MS35338-45
	149	96906	MS35338-45
	153	96906	MS35338-45
	153	96906	MS35338-45
	155	96906	MS35338-45
	159	96906	MS35338-45
	159	96906	MS35338-45
	169	96906	MS35338-45
	172	96906	MS35338-45
	172	96906	MS35338-45
	172	96906	MS35338-45
	172	96906	MS35338-45
0917361-8	109	30612	
0917365-7	147	96906	MS35338-43
0917365-9	1	96906	MS35338-43
	9	96906	MS35338-43
	39	96906	MS35338-43
	59	96906	MS35338-43
	65	96906	MS35338-43
0917366-7	149	96906	MS90726-13
	149	96906	MS90726-13
0917372-5	19	02978	X01801E
	29	02978	X01801E
	39	96906	MS51967-5
	47	96906	MS51967-5
	83	96906	MS51967-5
	85	96906	MS51967-5
	89	96906	MS51967-5
	99	96906	MS51967-5
	105	96906	MS51967-5
	105	96906	MS51967-5

PART NO.	PAGE	VENDOR CODE	VENDOR PART NO.
	113	96906	MS51967-5
	125	96906	MS51967-8
	125	96906	MS51967-5
	149	96906	MS51967-5
	149	96906	MS51967-5
	155	96906	MS51967-5
	172	96906	MS51967-5
	172	96906	MS51967-5
	172	96906	MS51967-5
0917373-2	165	96906	MS35338-50
0917373-3	157	96906	MS35338-50
	157	96906	MS35338-50
0917376-6	53	30612	
0917378-2	113	30612	
	113	30612	
	147	30612	
	153	30612	
0917379-0	145	30612	
0917385-7	55	16764	MS35649-282
0917389-9	53	30612	
0917415-2	1	96906	MS35649-302
	9	96906	MS3549-302
	39	96906	MS35650-302
0917421-0	85	96906	MS35691-18
0917452-5	39	96906	MS35207-263
0917469-9	129	11671	6A6-10H
0917496-2	75	79410	14338
0917611-6	93	30612	
0917642-1	35	30612	
0917658-7	65	30612	
0918065-4	79	79410	10-00-183-010
0918066-2	77	79410	10-00-183-028
0918187-6	118	95879	16368
	118	95879	16368
	151	95879	16368
0918199-1	23	02978	X00270
	147	30612	MS35338-47
0918213-0	147	96906	MS51967-11
0918249-4	155	30612	
0918264-3	113	30612	
	149	30612	
0918265-0	47	30612	
	53	96906	MS15795-812
	85	30612	
	147	30612	
0918266-7	61	96906	MS15795-814
0918266-8	131	30612	
	153	30612	
	155	30612	
	155	30612	
	155	30612	

PART NO.	PAGE	VENDOR CODE	VENDOR PART NO.
	155	30612	
0918267-6	85	96906	MS27183-16
0918269-2	153	30612	
0918431-8	66	30612	
0918432-6	51	30612	
0918447-4	89	96906	MS24665-217
	99	96906	MS24665-217
	147	30612	
0918448-2	105	96906	MS24665-114
	149	96906	MS24665-114
	159	96906	MS24665-114
0918451-6	85	96906	MS24665-351
	165	96906	MS24665-351
0918452-4	165	96906	MS24665-387
0918453-2	109	96906	MS24665-389
	109	96906	MS24665-389
0918470-6	71	96906	MS35425-40
0918547-1	23	02978	X17089
0918567-9	91	30612	
0918625-5	51	30612	
0918713-9	65	30612	
0918782-4	97	30612	
0918793-1	17	30612	
0918850-9	77	79410	10-00-052-004
0918887-1	9	79410	444866
0918888-9	75	79410	10-00-052-006
0918960-6	67	79470	3750X2
0919089-3	145	96906	MS90725-114
0919134-7	75	79410	X1516H
	79	79410	X1516H
0919136-2	123	79470	C5405X6X2
0919169-6	167	30612	
0919224-6	75	79410	179840
0919312-9	75	96906	MS35340-46
0919313-7	89	96906	MS24665-281
	89	96906	MS24665-281
	115	96906	MS24665-281
	165	96906	MS24665-281
0919326-9	61	96906	MS15795-812
	115	30612	
0919327-7	51	30612	
	51	96906	MS15795-818
0919332-7	109	96906	MS35338-52
	153	96906	MS35338-50
0919333-5	157	96906	MS51968-23
0919350-9	85	30612	
	109	30612	
0919381-4	89	30612	
0919386-3	85	30612	
	172	30612	
0919390-5	118	30612	

PART NO.	PAGE	VENDOR CODE	VENDOR PART NO.
0919393-9	65	30612	
0919423-4	109	96906	MS51967-14
	135	96906	MS51967-14
0919430-9	151	30612	
0919433-3	157	96906	MS90726-115
0919441-6	131	30612	
0919552-0	125	79470	C5129X6
0919953-0	23	02978	X06554
0920102-1	113	30612	
0920107-0	137	30612	
0920117-9	118	96906	MS24665-923
0920130-2	77	79410	444576
	137	79410	444576
0920131-0	75	79410	10-00-052-008
	77	79410	10-00-052-008
0920161-7	66	96906	MS35691-9
	157	96906	MS35691-9
0920215-1	39	30612	
0920263-1	85	96906	MS51968-5
	85	96906	MS51968-5
	149	96906	MS51968-5
	149	96906	MS51968-5
0920321-7	67	30612	
0920329-0	149	72962	29N
0920380-3	67	30612	
0920415-7	57	96906	MS90725-62
	137	96906	MS90725-62
	155	96906	MS90725-62
	155	96906	MS90725-62
	155	96906	MS90725-62
	155	96906	MS90725-62
0920427-2	71	96906	MS35335-35
	73	96906	MS35335-35
0920428-0	165	96906	MS35335-37
0920435-5	89	96906	MS35691-1
0920437-1	33	96906	MS51968-2
0920438-9	115	96906	MS51968-5
0920439-7	118	96906	MS35691-69
	118	96906	MS35691-69
0920571-7	153	30612	
0920572-5	65	96906	MS35206-263
0920587-3	37	96906	MS90725-164
0920655-8	39	79470	3350X2
0920743-2	153	30612	
0920787-9	159	96906	MS90725-29
0921055-0	51	96906	MS90725-14
0921118-6	125	30612	
0921176-4	125	96906	MS90725-111
	127	96906	MS90725-111
	145	96906	MS90725-111
0921203-6	123	79470	C5515X12
0921205-1	123	30612	
	129	11671	55-906-10-8309
	137	96906	MS28778-10
	137	96906	MS28778-12
	139	96906	MS28778-10
0921206-9	123	96906	MS28778-12
	123	96906	MS28778-12
	137	96906	MS28778-12
	157	96906	MS28778-12
	159	96906	MS28778-12
	159	96906	MS28778-12
0921210-1	39	96906	MS90725-62
	57	96906	MS35338-46
	66	96906	MS90725-60
	71	96906	MS90725-60
	73	96906	MS90725-60
	91	96906	MS90725-60
	123	96906	MS90725-60
	135	96906	MS90725-60
0921212-7	21	02978	X03368
0921214-3	123	30612	
0921221-8	105	96906	MS90725-38
	125	96906	MS90725-38
0921250-7	65	90763	SS48182
0921279-6	169	30612	
0921297-8	125	79470	C5706X6
0921332-3	39	96906	MS90725-32
	47	96906	MS90725-32
	65	96906	MS90725-32
	83	96906	MS90725-32
	91	96906	MS90725-32
	153	96906	MS90725-32
	172	96906	MS90725-32
0921333-1	53	96906	MS907525-34
	75	79410	10-00-183-027
	85	96906	MS90725-34
	99	96906	MS90725-34
	123	96906	MS90725-34
	125	96906	MS90725-34
	169	96906	MS90725-34
	172	96906	MS90725-34
0921342-2	157	72962	21NTE108
	157	72962	21NTE108
0921348-9	85	30612	
0921349-7	139	96906	MS28778-8
	169	30612	
0921351-3	137	30612	
0921355-4	65	78553	C7511-5618
	153	78553	C7511-5618-4
	153	78553	C7511-5618-4
	153	78553	C7511-5618-4

PART NO.	PAGE	VENDOR CODE	VENDOR PART NO.
	153	78553	C7511-5618-4
0921409-9	169	30612	
0921464-4	157	96906	MS51977-52
0921672-2	165	96906	MS16997-144
0921705-0	131	30612	
	153	78553	C7935-3816-38
0921719-1	89	96906	MS90725-42
0921728-2	159	30327	54FS012X12
0921759-7	89	30612	
0921876-9	21	02978	X03429
0921883-5	123	30612	
	123	30612	
	125	30612	
	173	30612	
0921885-0	123	30612	
	123	30612	
	123	30612	
	125	30612	
	125	30612	
	125	30612	
0921910-6	47	30612	
0921912-2	123	96906	MS35842-24
0921958-5	21	02978	X03938
	91	96906	MS90725-3
	102	30612	
0921959-3	113	30612	
	113	30612	
0921960-1	69	96906	MS9075-8
0921965-0	31	96906	MS90725-58
	35	96906	MS90725-58
	97	96906	MS90725-58
	99	96906	MS90725-58
	120	96906	MS90725-58
0921966-8	51	96906	MS90725-59
	53	96906	MS90725-59
	102	96906	MS90725-59
	131	30612	
	157	96906	MS90725-59
	159	96906	MS90725-59
0921967-6	51	96906	MS90725-61
	113	96906	MS90725-61
	113	96906	MS90725-61
0921969-2	27	02978	X03258
	113	96906	MS90725-64
	113	96906	MS90725-64
	137	96906	MS90725-64
	153	96906	MS90725-64
	153	96906	MS90725-64
0921971-8	75	79410	179845
0921972-6	27	02978	X03776
0921973-4	23	02978	X03259

PART NO.	PAGE	VENDOR CODE	VENDOR PART NO.
	97	02978	26XX03259
0921977-5	105	96906	MS90725-35
	125	96906	MS90725-35
	153	96906	MS90725-35
	153	96906	MS90725-35
	172	96906	MS90725-36
0921980-4	105	96906	MS90725-31
0921980-9	83	96906	MS90725-31
0921982-5	85	96906	MS90726-36
0922002-1	120	96906	MS24665-534
0922035-1	155	30612	
0922037-7	109	96906	MS51967-23
	153	96906	MS35691-51
0922130-0	23	02978	X03939
	115	96906	MS90725-67
	131	30612	
0922153-2	31	30612	
0922198-5	47	96906	MS35842-13
	47	30612	
0922212-6	109	96906	MS15003-6
0922457-7	173	30612	
0922471-8	99	96906	MS35691-29
0922519-4	91	30612	
0922523-6	123	79470	C5515X6
0922571-5	123	79470	C5515X4
	173	79470	C5515X4
0922645-7	168	96906	MS90725-116
0922660-6	123	96906	MS35842-11
0922887-5	109	95879	17208
	109	95879	17208
0922918-8	53	96906	MS90725-71
	99	30612	
0922946-9	163	30612	
0922974-1	123	30612	
0923014-5	109	30612	
0923087-1	105	30612	
0923092-1	66	30612	
0923114-3	125	96906	MS90725-109
0923124-2	75	79410	X807
0923163-0	123	79470	C5315X4
	125	79470	C5315X4
0923180-4	65	30612	
0923293-5	135	30612	
	157	96906	MS90726-114
0923320-6	169	96906	MS90725-119
	169	96906	MS90725-119
0923325-5	89	96906	MS90725-33
	113	96906	MS90725-33
0923335-4	117	96151	21047
0923341-2	51	96906	MS90725-6
	51	96906	MS90725-6

PART NO.	PAGE	VENDOR CODE	VENDOR PART NO.
	155	96906	MS90725-6
0923351-1	37	72962	2INE101
	37	72962	2INE101
0923376-8	166	30612	
0923464-2	109	96906	MS90725-179
0923548-2	139	96906	MS28775-111
	141	96906	MS28775-111
	143	96906	MS28775-111
0923572-2	119	30612	
0923578-9	125	30612	
0923582-1	135	30612	
0923649-8	135	30612	
0923690-2	1	79470	C3409X2
0923781-9	37	96906	MS90725-113
0923805-6	157	96906	MS21044N7
0923810-6	166	30612	
0923816-3	133	96906	MS28775-236
0923826-2	166	30612	
0923841-1	129	11671	55-014-8309
0923858-6	168	30612	
0923870-0	85	30612	
0923894-0	125	79470	7705X6
0923905-4	173	79470	C5515X6X8
0923912-0	66	96906	MS27183-18
0923938-5	147	96906	MS90725-72
0923989-8	139	96906	MS28775-024
	141	96906	MS28775-024
	143	96906	MS28775-024
0924025-0	89	30612	
0924048-2	129	11671	55-012-8309
0924060-7	97	30612	
0924085-4	9	02978	X00101B
0924092-0	129	11671	55-216-8309
0924093-8	160	30612	
	163	30612	
0924114-2	166	30612	
0924121-7	105	30612	
0924229-8	89	30612	
0924234-8	153	30612	
0924346-0	23	02978	X03363
0924356-9	153	30612	
	153	30612	
0924607-5	93	30612	
0924958-2	21	02978	X00203A
0924960-8	33	96906	MS51968-2
0925205-7	13	96906	MS90725-31
	61	96906	MS90725-57
	93	96906	MS90725-31
	159	96906	MS90725-31
0925295-8	123	79470	C5435X6
0925600-9	83	70434	6MA6MUFS

PART NO.	PAGE	VENDOR CODE	VENDOR PART NO.
0925670-2	153	96906	MS90725-34
	153	96906	MS90725-34
	153	96906	MS90725-34
0925719-7	97	96906	MS24665-360
	120	30612	
0925805-4	173	85757	3901-04544
0925806-2	91	30612	
0925984-7	172	85757	3901-06548
0926049-8	125	75272	COV1313
0926053-0	35	96906	MS90725-65
0926058-9	173	85757	3901-04546
0926243-7	109	30612	
	109	30612	
0926327-8	155	30612	
0926593-5	91	96906	MS90725-29
0926594-3	91	96906	MS90725-32
0926624-8	160	30612	
	163	30612	
0926625-5	135	30612	
0926671-9	75	79410	4776W
	77	79410	4776W
	77	79410	4476W
0926680-0	165	30612	
0926681-8	157	96906	MS51959-12
0926702-2	120	60038	LM4854BL
0926705-5	165	96906	MS16997-166
0926803-8	139	32705	223493
	141	32705	223493
0926955-6	83	70434	4MA4UFS
0926975-4	123	79470	C5706X4
0927023-2	75	79410	3-62A
0927149-5	59	16764	443527
0927150-3	59	16764	1967747
0927270-9	93	60038	LM102949
0927273-3	93	60038	LM102910
0927326-9	66	30612	
0927426-7	115	30612	
0927434-1	109	60038	L68111
0927435-8	109	60038	68149
0927436-6	109	60038	LM12711
0927437-4	109	60038	LM12749
0927445-7	71	75272	CDV0817
0927449-9	165	30612	
0927519-9	157	96906	MS90725-162
0927547-0	139	32705	186580
0927814-4	166	30612	
0927849-0	166	30612	
0927932-4	109	30612	
0927933-2	109	30612	
0928010-8	125	75272	CCV2113
0928046-2	123	75272	CDV1211

PART NO.	PAGE	VENDOR CODE	VENDOR PART NO.
0928075-1	75	79410	10-00-183-010
0928135-3	51	30612	
0928197-3	137	79136	5133-37
0928208-8	139	32705	181792
0928241-9	129	11671	55-013-8309
0928588-3	15	30612	
0928656-8	83	75272	COV1113
0928946-3	125	79470	C5705X4
0929124-6	65	90763	SS51045
0929191-5	123	22031	4603-16
0929306-9	37	30612	
	37	30612	
0929326-8	153	30612	
0929327-5	153	30612	
0929359-8	89	30612	
0929361-4	83	96906	MS27183-27
	155	30612	
0929362-2	25	02978	X14141
	27	02978	X05916
0929369-7	120	30612	
0929522-1	105	30612	
0929531-2	109	96906	MS90725-114
0929533-8	157	96906	MS90726-169
0929543-7	75	79410	110553
0929557-7	113	96906	MS90725-66
0929585-8	51	96906	MS24665-136
0929586-6	109	96906	MS24665-287
0929590-8	99	30612	
0929591-6	51	96906	MS20392-1C13
0929592-4	99	30612	
0929597-3	51	30612	
	125	30612	
0929607-0	97	30612	
0929652-6	160	30612	
	163	30612	
0930334-8	91	96906	MS51967-26
0930450-2	159	96906	MS51968-11
0930679-6	119	95879	1770B
0931130-9	93	30612	
0931139-0	77	79410	10-00-183-030
0931140-8	77	79410	10-00-183-031
0931193-7	125	30612	
0931314-9	109	30612	
0931433-7	119	30612	
0931576-3	65	77060	2977511
0931783-5	83	70434	6MA4FS
0932857-6	137	70417	AA634-4
0933081-2	93	30612	
0933874-0	129	30612	
1002933-8	75	79410	10-01-671-001
1002963-5	79	79410	T11-238A

PART NO.	PAGE	VENDOR CODE	VENDOR PART NO.
1007047-2	77	79410	T86-6.5
1013727-1	55	16764	1876668
1119448-7	41	96152	27-548
1123070-3	41	96152	80-187
1142670-7	55	16764	9436831
1142677-2	55	16764	1961323
1142678-0	55	16764	1970524
1148619-8	55	16764	908019
1172891-2	55	16764	1971528
1172893-8	55	16764	1116387
1172896-3	55	16764	801824
1172897-4	55	16764	1846900
1172899-5	55	16764	800832
1173329-2	55	16764	1851612
1174683-1	55	16764	1876163
3046862-3	49	18265	P10-1872
3057632-6	53	16764	800612
4001645-3	39	30612	
4024701-7	65	30612	
4042650-4	59	16764	809593
4042697-5	59	16764	818265
4044397-0	59	16764	1839345
4045429-0	41	96152	28-49
4046803-5	41	96152	99-7
	41	96152	99-7
4046824-1	41	96152	15A93
4046828-2	41	96152	24-213
4046832-4	41	96152	44-38
4046835-7	41	96152	80-169
4047137-7	41	96152	29-81
4051269-1	59	16764	1931129
4051272-5	59	16764	1927853
4051276-6	59	16764	1906945
4051277-4	59	16764	1926622
4051279-0	59	16764	1926618
4051281-6	59	16764	1928015
4051689-0	41	96152	15-483
	43	96152	15-483
4051736-9	41	96152	62-167
4052258-3	41	96152	24-292
4054348-0	55	16764	1969573
4054758-0	59	16764	1968396
4054799-2	55	16764	1951172
4055050-1	41	96152	15A270
4055321-6	41	96152	15A297
4055324-0	43	96152	78A4
4055871-0	59	16764	1940477
4060192-4	59	16764	1960864
4250061-1	97	60038	362A
4251645-0	66	75272	TC79
	67	30612	

PART NO.	PAGE	VENDOR CODE	VENDOR PART NO.
4251726-8	35	30612	
	35	30612	
4252197-1	83	70434	6M-6UFS
4252647-5	83	70434	6MAX6UFS
4253048-5	66	30612	
4253050-1	97	60038	368
4253253-1	91	60038	14276D
4253254-9	91	60038	14139
4253263-0	109	60380	B16160H
4253297-8	91	11314	40438
4253299-4	91	60038	W07
4253423-0	66	30612	
4253456-0	31	66295	26
	31	66295	26
4253543-5	77	79410	B207AG
4254037-7	97	60038	25580
4254038-5	97	60038	22520
4254318-1	120	60038	LM48510
4254481-7	66	96906	MS21333-4
4254608-5	129	11671	58A5000-150
4254654-9	81	79410	4840E
4254658-0	75	79410	B109A
	75	79410	B109A
4254666-3	79	79410	T11-107
4254667-1	75	79410	T11-110
4254697-8	79	79410	T11-108
4254703-4	120	60038	LM67048
4254704-2	120	60038	LM67010
4254773-7	91	60038	K91507
4254797-6	168	30612	
4254846-1	66	02660	31884
	66	02660	31884
4254864-4	73	30612	
4254912-1	93	76680	450085
4254976-6	66	93608	400D113
	66	93608	400D113
4255039-2	147	82465	29LFHU51618
4255041-8	53	82465	29LFH43816
	113	82465	29LFH43816
4255060-8	153	30612	
4255068-1	147	30612	
4255126-7	172	30612	
4255183-8	51	96906	MS16633-31
	89	79136	X5133-31
4255195-2	66	30612	
4255271-1	69	02660	42332-2
	89	02660	42332-2
4255355-2	83	59730	TY24M
4255385-9	69	30612	
4255400-6	33	78643	R103
4255401-4	51	79136	X5133-37
4255431-1	66	30612	
4255470-9	81	79410	4840S
4255481-6	105	30612	
	105	30612	
4255521-9	61	30612	
	65	00779	321235
	89	02660	321235
4255574-8	39	86579	110-3116
4255744-7	123	33544	CDU1113
4331040-8	91	60038	N07
4335601-3	151	30612	
4347088-9	39	30612	
4377201-1	93	30612	
4408654-1	89	59730	RB8633
4408655-1	39	59730	RB873
	65	59730	RB873
	65	59730	RB873
	65	59730	RB873
	65	59730	RB873
	113	30612	
4501458-6	91	80201	11841
4507415-0	105	30612	
	105	30612	
4511629-0	83	81321	6664270
4511898-1	85	77260	4070-3
4612316-2	47	30612	
4701704-1	157	72625	C331134
	165	72625	C331134
4702247-0	67	16764	7604
4704830-1	65	30612	
4705279-0	65	71400	AGC10
4706891-1	97	30612	
	120	30612	
4707059-4	97	30612	
4707060-2	91	30612	
4707234-3	91	30612	
4707307-7	102	30612	
4707331-7	85	30612	
4707401-8	105	30612	
4707440-6	91	30612	
4707650-0	77	79410	A5512X12
4707711-0	95	27995	WA31-31
4707712-8	95	27995	WA31-30
4708304-3	35	76110	X175
4708313-4	99	63477	FC673
	101	63477	FC673
4708318-3	99	63477	FC602
	101	63477	FC602
4708319-1	99	63477	FC603
	101	63477	FC603
4708362-1	65	71400	4522

PART NO.	PAGE	VENDOR CODE	VENDOR PART NO.
4708605-3	83	70434	4MA4UFSX
4709114-5	125	30612	
4709816-5	113	77915	601
4710053-2	91	30612	
4710092-0	91	95878	131000
4710442-7	35	92850	218
4710809-7	102	78189	114-05
4710934-3	99	30612	
4711590-2	35	30612	
4713023-2	120	30612	
4713374-9	99	63477	FE3085D
	101	63477	FE3085D
4713963-9	97	30612	
4714616-2	135	30612	
4714624-6	172	30612	
	172	30612	
	172	30612	
4714907-5	172	30612	
4715026-3	67	30612	
4715027-1	66	30612	
4715028-9	67	30612	
4715032-1	66	30612	
4715037-0	67	30612	
4715712-8	157	30612	
4716088-2	35	30612	
4716827-3	91	30612	
4716873-7	39	79470	131-56730
4717072-5	102	63477	FD20945A
	103	63477	FD20945A
4718482-5	151	30612	
4719642-3	102	30612	
4719720-7	157	30612	
4720549-7	85	70485	1303
	99	70485	1303
4721573-6	69	16764	1116781
4722511-5	105	92867	6110C42-775
4724666-5	66	02660	278
4724667-0	39	02660	236
4724667-3	66	02660	236
	66	02660	236
	67	02660	236
	113	30612	
4724728-3	68	30612	
4724733-3	68	15605	7118K2
4726629-1	67	63477	FC7715
4726962-6	113	30612	
4727352-9	68	30612	
4730551-1	39	78480	0W449
	45	78480	0W449
4734450-2	99	30612	
4735714-0	39	57733	72030

PART NO.	PAGE	VENDOR CODE	VENDOR PART NO.
4735718-1	51	30612	
4736044-1	39	02660	277
	67	02660	277
4737615-7	93	30612	
4741699-5	101	63477	FC3163
4742113-6	151	30612	
4744948-3	91	30612	
4747109-9	91	30612	
4747196-6	99	63477	FC2672
4747691-6	93	02397	DLM7-79
	107	02397	DLM7-79
4747693-2	107	30612	
4749382-0	39	49234	1273-10
4749684-9	93	30612	
4750170-5	83	30612	
4750203-4	105	30612	
4751627-3	91	30612	
4751644-8	91	30612	
4751804-8	87	30612	
4751985-5	91	30612	
4752002-8	73	30612	
4753681-8	139	07322	Q11
	141	07322	Q11
	143	07322	Q11
4755380-5	73	30612	
4755381-3	73	30612	
4755785-5	37	76005	J8006
4755930-7	97	30612	
4757678-0	66	77060	5286201
4757912-3	68	71400	AGC20
4758727-4	120	30612	
4760149-7	9	70040	1513462
4760448-3	83	30612	
4761006-8	97	30612	
4761032-4	73	30612	
4761270-0	51	73134	R6-14-8
4765514-1	51	92850	3316D
4765753-1	115	30612	
4765796-0	157	30612	
4766588-0	65	30612	
4767130-0	39	30612	
	65	30612	
4767762-0	109	30612	
4767763-8	109	30612	
4768993-0	67	63477	FC3511
4769239-7	83	30612	
4769247-0	111	72210	S5340
4769248-8	111	72210	S1223
	121	72210	S1223
4769566-3	135	30612	
4769885-7	102	30612	

PART NO.	PAGE	VENDOR CODE	VENDOR PART NO.
4769886-5	102	30612	
4769887-3	102	30612	
4770449-9	67	20984	127STR12
4772127-9	65	30612	
4774455-2	123	30612	
4774640-9	51	30612	
4775866-9	66	74400	M2389
4775867-7	66	30612	95
4775868-5	66	30612	
4775869-3	66	30612	
4776665-4	137	93784	4499-2
4776666-2	137	93784	4499-4
4781446-2	66	30612	
	111	72210	S5896
	121	72210	S5896
4784266-1	99	87946	FBE4806
4784720-7	99	30612	
4785009-4	147	30612	
4785070-6	113	73470	33050
4786323-8	113	77640	453077A1
4786324-6	113	77640	029037
4786325-3	113	77640	401081
4786326-1	113	77640	029031
4787365-8	91	30612	
4789058-7	47	18265	P2348
4790065-9	39	30612	
4795693-3	97	30612	
4795884-8	91	30612	
4797273-2	91	30612	
4798027-1	67	30612	
4803599-2	157	92563	BR704
4805651-9	123	30612	
4806357-2	131	30612	
4807683-0	109	30612	
4808348-9	123	30612	
4808387-7	109	60380	15SF24X8
4808392-7	109	30612	
4808396-8	109	30612	
4808397-6	109	30612	
4808402-4	102	30612	
4808509-5	21	02978	X03043A
4809161-5	172	30612	
4809524-4	165	30612	
4809584-8	165	30612	
4809718-2	135	30612	
4810047-9	47	30612	
4810232-1	65	30612	
4810695-9	47	30612	
4811136-3	83	70434	4MAX4UFS
4811824-4	109	80900	NAN181
4812705-4	118	30612	

PART NO.	PAGE	VENDOR CODE	VENDOR PART NO.
4812920-9	157	30612	
	165	30612	
4812929-0	157	30612	
	159	30612	
	165	30612	
4812930-8	157	30612	
	159	30612	
	165	30612	
4812935-7	157	30612	
4812974-6	157	30612	
4813026-4	173	30612	
4813781-4	157	30612	
	159	30612	
4814108-9	135	30612	
4814109-7	135	30612	
4814133-7	135	30612	
4814134-5	135	30612	
4814246-7	123	30612	
4814364-8	1	70040	5654782
4814702-9	85	30612	
4814975-1	68	30612	
4816113-7	157	30612	
	159	30612	
4816375-2	159	30612	
4816376-0	159	30612	
4816384-4	67	30612	
4816684-7	157	70026	R944-12
4816708-4	160	30612	
	163	30612	
4816747-2	160	30612	
4816748-0	160	30612	
	163	30612	
4816749-8	119	30612	
	135	30612	
	160	30612	
	163	30612	
4816947-8	160	30612	
	163	30612	
4817087-2	159	30612	
4817727-3	165	30612	
4818260-4	65	70040	6462577
4818261-2	65	70040	6431382
4818262-0	65	70040	6489590
4818263-8	65	70040	6473718
4818813-0	51	30612	
4818848-6	93	30612	
4818849-4	93	30612	
4818850-2	93	30612	
4818851-0	93	30612	
4818852-8	93	30612	
4819216-5	168	30612	

PART NO.	PAGE	VENDOR CODE	VENDOR PART NO.
4819814-7	157	30612	
4820955-5	153	30612	
4820972-0	35	91561	7008-169
4820980-3	118	72210	S230041
	121	72210	S230041
4820995-1	155	30612	
4821003-3	153	30612	
4821743-4	159	30612	
4821902-6	159	07988	PD2788165
4822341-6	83	30612	
4822530-4	68	30612	
4822613-8	123	30612	
4822618-7	165	30612	
4822811-8	165	30612	
4822814-2	165	30612	
4823097-3	168	30612	
4823121-1	109	30612	
4823231-8	93	30612	
4823283-9	99	30612	
4823285-4	99	30612	
4823331-6	165	30612	
4823391-0	131	30612	
4824223-4	123	30612	
4824293-7	83	30612	
4824664-9	99	92850	3032
4825041-9	135	30612	
4826128-3	35	30612	
4826143-2	39	30612	
4826244-8	123	30612	
4826246-3	123	30612	
4826276-0	151	30612	
4827755-2	123	30612	
4828179-4	157	30612	
4828474-9	149	30612	
4828568-8	157	30612	
4828803-9	131	30612	
4829089-4	67	30612	
4829299-9	87	30612	
	87	30612	
4829335-1	135	30612	
4829439-1	119	30612	
4829621-4	157	30612	
4829757-6	157	30612	
4830173-3	69	21003	2U71R12L
4830998-3	109	30612	
4831754-9	39	30612	
4831977-6	109	30612	
4831978-4	109	30612	
4832052-7	123	30612	
4832715-9	113	87946	FBE4253
4832723-3	113	30612	
4832732-4	115	30612	
4832743-1	61	30612	
4832944-5	91	30612	
4833178-9	147	30612	
4833571-5	160	30612	
	163	30612	
4833733-1	125	30612	
4834705-8	165	32508	80
4834731-4	89	30612	
4835376-7	165	30612	
4835378-3	131	30612	
4836109-1	89	30612	
4836253-7	131	30612	
4838336-8	93	30612	
4838338-4	91	30612	
	93	30612	
4838778-1	93	23040	C7AW4143A
4839229-4	123	30612	
	125	30612	
4839271-6	157	30612	
	160	30612	
4839272-4	160	30612	
4839274-0	160	30612	
4839277-3	163	30612	
4839404-3	163	30612	
4839703-8	93	30612	
4839704-6	93	79187	14-04-000-003
	95	79187	14-04-000-003
4839751-7	165	30612	
4839752-5	157	30612	
4839752-8	165	30612	
4840790-2	113	30612	
4841221-7	137	30612	
4841879-2	47	18265	FWG05-2575
	49	18265	FWG05-2575
4842160-8	89	53268	5C107X1A
4842513-6	147	30612	
4842815-5	89	30612	
4843526-7	137	30612	
4843534-1	137	30612	
4843535-8	125	30612	
4843536-6	123	30612	
4843539-0	69	30612	
4844078-8	109	30612	
4844555-5	169	02614	646048
	170	02614	646048
4844690-0	169	02614	75340
	171	02614	75340
4844692-6	169	30612	
4844775-9	147	30612	
4844885-0	147	30612	

PART NO.	PAGE	VENDOR CODE	VENDOR PART NO.
4845319-5	123	30612	
4845597-6	123	30612	
4845598-4	123	30612	
4845678-4	91	30612	
	131	30612	
4846114-9	123	30612	
4846354-1	145	30612	
4846665-0	137	30612	
4847462-3	113	30612	
4847561-0	115	30612	
4847694-9	91	30612	
4847837-4	91	30612	
4848486-9	53	16764	1961291
4848758-1	35	30612	
4848885-2	39	02978	X1698
4848948-8	163	30612	
4851222-2	113	30612	
4855689-8	91	30612	
	131	30612	
4856321-7	91	30612	
4856552-7	157	30612	
4856611-1	125	30612	
4856612-9	123	30612	
4856615-2	27	81300	5-9308
4856618-6	53	30612	
4856620-2	39	30612	
4856621-8	109	30612	
4856625-1	115	30612	
4856627-7	113	30612	
4856639-2	65	30612	
4856671-5	153	30612	
4856781-2	39	30612	
4857172-3	123	30612	
4857193-9	99	30612	
4857245-7	37	30612	
4857249-9	85	30612	
4857258-0	153	30612	
4857348-9	115	30612	
4857358-8	99	30612	
4857708-4	119	30612	
4857829-8	135	30612	
4857878-5	61	19728	1BT4701C
	63	19728	1BT4701C
4857898-3	37	30612	
4858103-7	61	02978	F400M293
4858128-4	27	77890	FPN1072DX
4858181-3	85	30612	
4858197-9	31	24161	4283-10
4858198-7	31	24161	4283-13
4858279-5	47	30612	
4858427-0	47	30612	
4858996-4	87	76260	50749
4859095-4	135	30612	
4860602-4	35	30612	
4861163-6	153	30612	
4861170-1	113	30612	
4861540-5	123	30612	
4861541-3	123	30612	
4861547-0	153	30612	
4861727-8	89	30612	
4861729-4	89	30612	
4861733-6	89	30612	
4861736-9	89	30612	
4861739-3	89	30612	
4861809-4	123	92863	M3544-2500
	133	92863	M3544-2500
4861910-0	89	30612	
4861993-6	35	30612	
4862045-4	33	30612	
4862524-8	89	30612	
4863123-8	157	30612	
	163	30612	
4863192-3	119	30612	
4863193-1	119	02697	TP024
4863194-9	119	30612	
4863474-5	65	30612	
4864082-5	51	30612	
4864085-8	51	30612	
4864097-3	153	30612	
4864169-7	153	30612	
4864447-0	118	30612	
	119	30612	
4864813-3	135	30612	
4864816-6	127	30612	
4866350-4	53	30612	
4867466-7	65	27780	99039
4867521-0	119	30612	
4867522-7	119	30612	
4867958-3	157	30612	
4867959-1	157	30612	
4868125-8	51	30612	
4868432-8	85	30612	
4868749-5	51	30612	
4869251-1	85	30612	
4869549-8	155	30612	
4873188-9	153	30612	
4873189-7	153	30612	
4873387-7	93	30612	
4873388-5	93	30612	
4873421-7	102	30612	
4873631-8	65	77326	LS193J
4873632-6	65	30612	

PART NO.	PAGE	VENDOR CODE	VENDOR PART NO.
4874220-9	153	30612	
4874437-9	73	79410	10-01-000-058
	75	30612	
4874858-6	118	30612	
4875492-3	119	30612	
4875573-0	145	30612	
4876715-6	85	30612	
4876955-8	113	30612	
4877044-0	113	30612	
4877430-1	167	30612	
4877822-9	123	30612	
4878164-5	153	30612	
4879296-4	99	30612	
4879818-5	155	30612	
4880496-7	137	30612	
4880497-5	137	30612	
4880502-2	137	30612	
4880714-3	155	30612	
4880716-8	155	30612	
4880718-4	155	30612	
4880720-0	153	30612	
4880722-6	153	30612	
4881113-7	65	30612	
4881389-2	41	96152	TSX1001
4881389-3	39	96152	TSX1001
4881489-8	65	30612	
4881588-0	65	30612	
4882371-0	147	30612	
4882936-0	31	30612	
4883374-3	53	16764	1102940
	55	16764	1102940
4884041-7	73	75958	SSL11
4884062-3	113	77640	450162
4884222-3	105	30612	
	105	30612	
4884230-6	105	30612	
4885085-3	163	30612	
4885303-0	153	30612	
4885883-1	57	16764	1109086
	59	30612	
4886753-5	65	30612	
4886785-7	137	32705	CM1102R20TDDL21-
4886865-7	113	96151	214-1064-001
	117	96151	214-1064-001
4887288-1	155	30612	
4887339-2	113	30612	
4888301-1	51	30612	
4888561-1	113	30612	
4889580-9	61	16764	1115065
4889783-9	71	30612	
4889803-5	71	16764	1980347
4889807-6	71	30612	
4890331-4	137	30612	
4890332-2	137	30612	
4890333-0	137	30612	
4891714-0	149	30612	
4891803-1	1	02978	F163A604804S
4891804-9	1	02978	F163A604604R
4891874-2	71	30612	
4892156-3	127	11671	49350
	129	11671	49350
4892371-8	71	30612	
4893255-2	85	30612	
4894674-3	167	30612	
4894675-0	167	30612	
4894676-8	167	30612	
4905003-2	129	11671	20901
4905788-8	75	79410	4806B
4905790-4	75	79470	4671M
4905792-0	75	30612	
4905793-8	75	79410	AT12G106
4905843-1	157	70026	MR375-12
4905864-7	166	30612	
	166	30612	
4905883-7	81	79410	AT12-16A
4905897-7	39	70040	6428316
4906096-5	133	92863	M3331-5100
4906099-1	163	30612	
4906100-5	160	30612	
4906113-8	166	30612	
4906179-9	166	30612	
4906387-8	129	11671	11803
4906401-7	95	27995	14-04-333-001
4906403-3	95	27995	14-04-032-001
4906404-1	95	27995	14-04-056-001
4906406-3	95	79187	WA31A
4906408-2	149	30612	
4906409-0	75	79410	10-01-156-001
4906418-1	59	16764	1952410
4906618-6	149	30612	
4906800-0	166	30612	
4907245-7	95	30612	
4907320-8	131	30612	
4907382-8	149	30612	
4907383-6	149	30612	
4907476-8	149	30612	
4907479-2	166	30612	
4907589-6	75	79410	3-61
4907649-0	149	30612	
4907656-5	75	79410	3-4A60C
4907794-3	49	18265	P12-2510
4908156-5	31	67049	A259469

PART NO.	PAGE	VENDOR CODE	VENDOR PART NO.
4908201-9	139	32705	282027
	141	32705	282027
	143	32705	282027
4908202-7	139	32705	284155
	141	32705	284155
	143	32705	284155
4908203-5	139	32705	246632
	141	32705	246632
	143	32705	246632
4908204-3	139	32705	284156
	141	32705	284156
	143	32705	284156
4908205-0	139	32705	284154
	141	32705	284154
	143	32705	284154
4908206-8	139	32705	259871
4908207-6	139	32705	232799
4908208-4	139	32705	283856
	141	32705	283856
	143	32705	283856
4908209-2	139	32705	286669
	141	32705	286669
	143	32705	286669
4908210-0	139	32705	226161
	141	32705	226161
4908211-8	139	32705	237736
	141	32705	237736
4908212-6	139	32705	307198
	141	32705	307198
4908213-4	139	32705	223489
	141	32705	223489
4908214-2	139	32705	222640
	141	32705	222640
	143	32705	222640
4908215-9	139	32705	117717
	141	32705	117717
	143	32705	117717
4908216-7	139	32705	223388
	141	32705	223388
	143	32705	223388
4908217-5	139	32705	1656
	141	32705	1656
	143	32705	1656
4908219-2	137	32705	223153
4908224-1	139	32705	922906
	141	32705	922906
	143	30612	
908325-6	77	79410	10-011-039-001
4908501-2	13	02978	Y400G00232
4908502-0	13	02978	Y400G00231
4908504-6	7	02978	X18546

PART NO.	PAGE	VENDOR CODE	VENDOR PART NO.
4908505-3	7	02978	F400G00211
4908507-9	1	02978	F600B00247
4908510-2	15	02978	F218L00204
4908511-1	15	02978	F400L00210
4908512-9	13	02978	Y400100215
4908513-7	13	02978	F400100251
4908514-5	13	02978	F140A00216010
4908515-2	13	02978	F600102520
4908517-8	1	02978	F0600L00211
4908518-6	25	02978	X04057
	25	02978	X04057
4908519-4	1	02978	15SL00211
4908520-2	11	02978	F401F00274
4908521-0	11	02978	F401F00275
4908522-8	11	02978	X26119
4908523-6	11	02978	F401F00273
4908524-4	1	02978	41AL00200
4908525-1	1	02978	X00365
4908526-9	1	02978	10EL00230
4908530-1	27	02978	X12517
4908532-7	27	02978	X02376
4908534-3	29	02978	X05695
4908536-8	1	02978	F600B00242
4908537-6	1	02978	06503
4908538-4	1	02978	F124A00201
4908539-2	1	02978	X02272
4908560-8	1	02978	X00137A
	23	02978	X00137A
	25	02978	X00137A
	27	02978	X00110
4908562-4	13	02978	F601100301
4908563-2	5	02978	X00675
4908564-0	7	02978	F400D00202
4908565-7	7	02978	F600A00214
4908566-5	13	02978	Y400100203
4908568-1	13	02978	F400G00222
4908569-9	13	02978	X00506
4908574-9	13	02978	CUT03234
4908575-6	13	02978	F601160200
4908576-4	21	02978	X07005
4908578-0	1	02978	X14324
4908580-6	1	02978	X018327
4908581-4	17	02978	X03924
4908585-5	9	02978	F401A00403
4908586-3	25	02978	X14323
	25	02978	X14323
4908588-9	29	02978	C400K00215
4908590-5	13	02978	X18521
4908592-1	9	02978	X06906
4908593-9	9	02978	X14134
	27	02978	X01435

PART NO.	PAGE	VENDOR CODE	VENDOR PART NO.
4908595-4	1	02978	X19002
	9	02978	X19002
4908596-2	17	02978	X02958
4908600-2	1	02978	F401B00301
4908602-8	17	02978	F600B00399
4908604-4	9	02978	X22105026
4908605-1	9	02978	X22109
4908607-7	13	02978	F600100347
4908609-3	13	02978	F601100303
4908611-9	1	02978	F600A03980
4908612-7	1	02978	F600A03990
4908613-5	1	02978	F400L03480
4908614-3	21	02978	F224C00317
4908615-0	21	02978	F400B00377
4908617-6	27	02978	F0600L00211
4908618-4	1	02978	F600B00470
4908625-9	29	02978	F218K00202
4908626-7	1	02978	F400B00359
4908628-3	5	02978	F400C00510
4908640-8	1	02978	X06920
4908641-6	5	02978	F600G03911
4908647-3	5	02978	F400G03281
4908653-1	5	02978	F400G03381
4908666-3	5	02978	F163T00103
4908685-3	1	02978	F4U01002
	9	02978	FU1002
	25	02978	FU01002
	29	02978	FU01002
4908690-3	13	02978	FT400T00181
4908699-4	15	02978	8UL00212
4908701-8	1	02978	F400L02911
4908703-4	15	02978	X04182
4908710-9	29	02978	F60K00303
4908712-5	15	02978	D600L02120
4908714-1	17	02978	F400B00255
	17	02978	F400B00255
4908715-8	17	02978	T427B00201
4908741-4	15	02978	F600H00218
4908742-2	15	02978	F600H00217
4908744-8	15	02978	D600L00204
4908745-5	15	02978	X00584
4908746-3	15	02978	F600L413
4908747-1	15	02978	X17095
4908748-9	15	02978	C400L00231
4908749-7	15	02978	F400L02511
4908750-5	15	02978	17EL00300
4908751-3	15	02978	17EL00204
4908753-9	27	02978	F226K00223
4908754-7	27	02978	0A200K03040
4908755-4	27	02978	F400K00340
4908756-2	27	02978	F400K00392

PART NO.	PAGE	VENDOR CODE	VENDOR PART NO.
4908757-0	27	02978	F400K00391
4908759-6	27	02978	K600K00220
4908768-7	55	16764	1876681
4908780-2	1	02978	X00334
4908781-0	27	30612	
4908782-8	27	02978	X07096
4908783-6	27	02978	X03794
4908784-3	1	02978	X20063
4908786-9	25	02978	F400E00303
4908789-3	39	70040	6440314
4908941-0	95	27995	14-04-410-000
4908995-5	59	16764	1938178
4908997-2	59	16764	1958465
4909100-2	63	19728	1BP2040LA
4909101-0	63	19728	1BB2042SS1
4909102-8	63	19728	1BT1111
4909103-6	63	19728	1GP1016D
4909104-4	63	19728	1BT2004LAS
4909105-1	63	19728	1BT14A
4909110-1	63	19728	P90-423
4909112-7	63	19728	1BT1035
4909113-5	63	19728	8X1590
4909114-3	63	19728	1BT1035
4909118-4	75	79410	10-01-045-004
4909119-2	81	79410	10-00-016-002
4909121-8	77	79410	10-01-565-013
4909124-2	79	79410	10-01-237-006
4909126-7	79	79410	T22-213
4909127-5	79	79410	10-01-040-002
4909128-3	79	79410	10-10-239-002
4909129-1	79	79410	10-01-045-003
4909131-7	79	79410	10-00-183-010
4909132-5	79	79410	10-01-239-001
4909133-3	79	79410	10-01-236-001
4909134-1	79	79410	10-01-156-004
4909135-8	77	79410	10-01-736-001
	79	79410	10-01-736-001
4909138-2	79	79410	10-00-040-001
4909139-0	79	79410	10-01-156-006
4909140-8	79	79410	10-01-237-002
4909142-4	79	79410	10-00-043-005
4909289-3	129	11671	21980
4909316-4	75	79410	10-01-107-008
4909483-2	129	30612	
4909493-1	129	11671	10665
4909636-5	33	02978	F209S03051
4909637-3	33	02978	F400S00310
4909638-1	33	02978	H260S00201
4909639-9	23	02978	F401B03281
4909730-6	109	30612	
4909762-9	5	02978	F401H00200

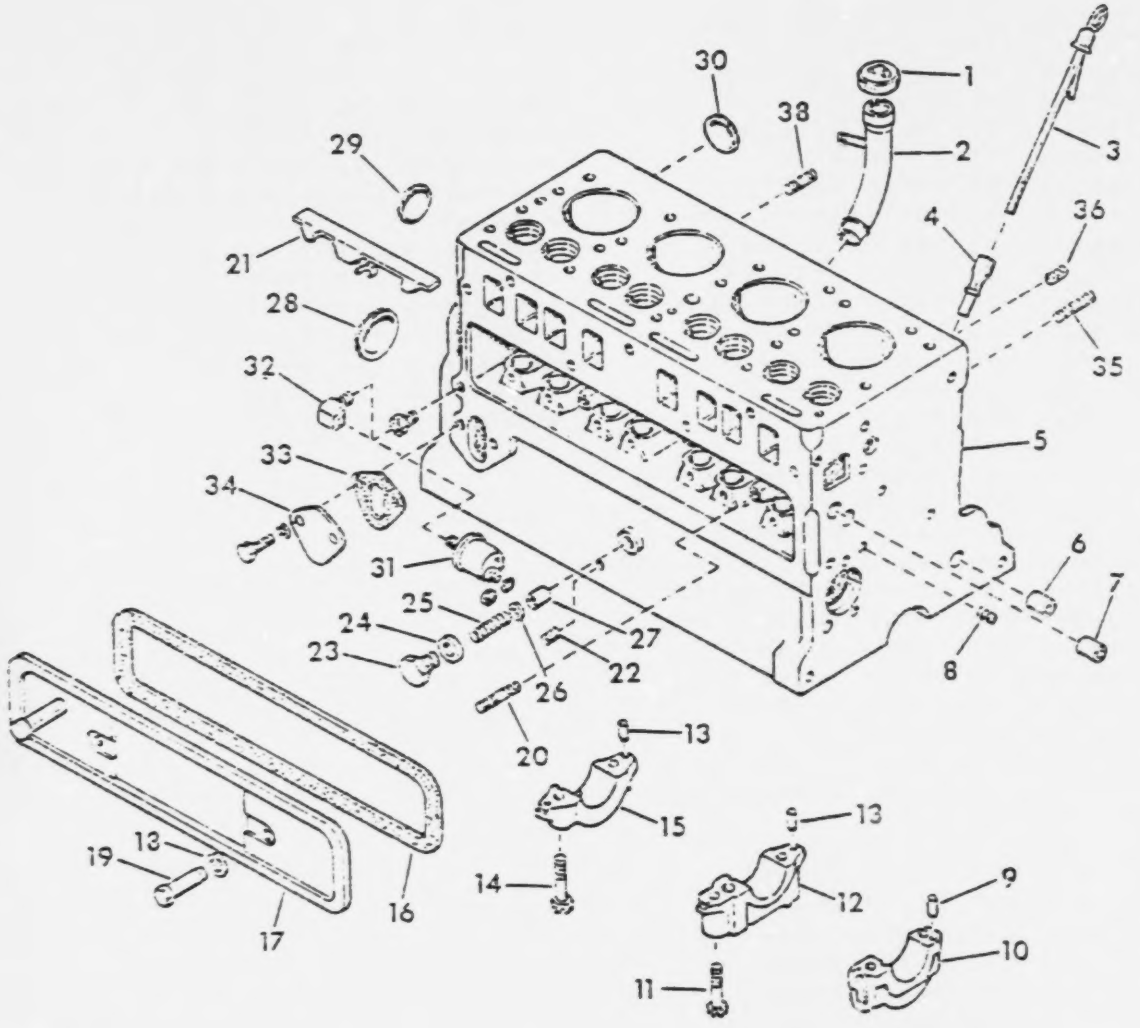
PART NO.	PAGE	VENDOR CODE	VENDOR PART NO.
4909763-7	5	02978	F16C00210
	127	02978	F162C00210
4909764-5	5	02978	F209C00203
4909766-0	23	02978	F4U02013
	27	02978	F4U02013
4909767-8	21	02978	F401C04100
4909768-6	25	02978	F400E00329
4909770-2	127	02978	F244H00308
4909771-0	23	02978	F162H00311
4909772-8	23	02978	F209K02260
4909773-6	23	02978	F209K00330
4909774-4	23	02978	F209B00208
4909775-1	127	30612	
4909776-9	27	02978	F600K04521
4909778-5	27	02978	F6T01011
4909779-3	15	02978	F6T02002
4909780-1	15	02978	F600L04132
4909782-7	9	02978	F401A03691
4909783-5	7	02978	F226D04002
4909786-8	7	02978	F400T00352
4909788-4	21	02978	F401B00403
4909793-4	15	02978	D600H00220
4909794-2	23	02978	F209B00413
4909797-5	27	02978	F401K00317
4909800-7	7	02978	F163T00119
4909817-1	25	02978	16SE00203
4909818-9	29	02978	F400K00380
4909819-7	27	02978	X02443
4909820-5	23	02978	X03942
	33	02978	X03942
4909821-3	29	02978	X04102
4909822-1	23	02978	F600K00266
4909823-9	23	02978	X01800C
4909824-7	1	02978	D600B00203
4909825-4	1	02978	X06962
4909826-2	25	02978	X03695
4909827-0	23	02978	X00546
4909828-8	61	02978	F400M00279
4909829-6	9	02978	X12943
4909832-0	21	02978	X02949
4909834-7	165	30612	
4909835-3	39	02978	F6U1002
4909854-4	33	02978	F400S03480
4909855-1	33	02978	F400S00463
4909858-5	33	02978	Y112S00208
4909863-5	87	76260	50750
4909868-4	73	13445	9224-07
4909869-2	77	79410	10-01-534-002
	79	79410	10-01-534-002
	81	30612	
4909917-9	75	79410	10-01-534-002

PART NO.	PAGE	VENDOR CODE	VENDOR PART NO.
4909934-4	33	02978	X17051
4909942-7	41	96152	13-154B
4909947-6	41	96152	46A244
4909948-4	41	96152	47A101
4909949-1	41	96152	49A103
4909951-8	41	96152	
4909954-2	41	96152	233-608
4910030-8	5	02978	F400H00357
4910031-6	23	02978	F244H00202
4910032-4	13	02978	F400H00418
4910068-8	27	02978	X03776
4910070-4	1	02978	X04038
4910075-3	21	02978	X06541
4910078-7	15	02978	X18387
4910086-0	81	79410	10-00-016-011
4910088-6	119	30612	
4910105-8	61	02978	SP201S00016RD
4910178-5	63	30612	
4910258-5	13	02978	F601100304
4910352-6	79	79410	WG10-01-036-002
4910545-5	149	30612	
4910628-9	129	11671	26308
4910734-5	167	30612	
4910775-8	19	02978	F600L3750
4910776-6	19	02978	F600L00255
4910777-4	19	02978	F600L00445
4910779-0	19	02978	X14219
4910780-8	19	02978	X3232
4910781-6	19	02978	X12533
4910784-0	19	02978	X08254140
4910785-7	19	02978	X08254190
4910807-9	19	02978	F400L00358
4910809-8	19	02978	F600L00445
4910810-3	19	02978	F600L03750
4910811-1	19	02978	X8254180
4910812-9	19	02978	X8254280
4912140-3	1	02978	F400L04290
4912141-1	33	02978	X5692102
4912142-9	33	02978	N56500205
4912144-5	1	02978	F226A00311
4912176-7	61	30612	
4912200-5	17	02978	F4001300282
4912201-3	17	02978	X14583
4912238-5	75	02978	10-01-689-021
	81	79410	10-01-689-021
4912255-9	75	30612	
4912280-7	79	79410	10-01-156-006
4912281-5	79	79410	10-01-237-004
4912282-3	79	79410	TE22E84
4912283-1	79	79410	10-01-237-004
4912284-9	79	79410	10-01-045-005

PART NO.	PAGE	VENDOR CODE	VENDOR PART NO.
4912285-6	79	79410	10-00-183-003
4912314-4	59	16764	1114458
4912342-5	81	79410	10-11-666-004
4912343-3	81	79410	10-01-125-005
4912344-5	81	79410	10-01-625-003
4912345-8	81	79410	10-11-666-005
4912346-6	81	79410	10-01-124-003
	81	79410	10-01-124-003
4912350-8	75	30612	
4912409-2	129	11671	32822
4912459-7	117	30612	5776
4912466-2	117	96151	14317
4912469-7	117	96151	7443
4912470-4	117	96151	15074
4912473-8	117	96151	5544
4912510-7	129	30612	
4912628-7	41	96152	49-163
4912740-0	55	16764	1891055
4912742-6	41	96152	26-942
4912743-4	43	96152	286-172
4912747-5	7	02978	F163A04081E
4912748-3	7	02978	X07011
4912868-9	129	11671	64BC6-104
4912928-1	129	11671	11817
4912929-9	129	11671	11944
4912930-7	129	11671	13714
4912931-5	129	11671	12713
4912932-3	129	11671	11817
4912933-1	129	11671	12862
4912934-9	129	11671	12847
4912935-6	129	11671	11974
4912936-4	129	11671	11794
4912946-3	41	96152	121-501
4912947-1	41	96152	12A258
4912948-9	43	96152	83-476
4913144-4	55	16764	1894595
4913145-1	55	16764	1894594
4913252-5	63	19728	1BT3478LE
4913284-8	63	30612	
4913304-4	59	16764	1194321
4913371-3	59	16764	19741577
4913372-1	59	16764	1974183
4913373-9	59	16764	1970263
4913376-2	59	16764	1893370
4913456-2	137	32705	CM11N02R20T21-16
	139	32705	CM11N02R20T21-16
4913457-0	137	32705	CM11N07D21-161
	141	32705	CM11N02D21-161
4913458-8	137	32705	CM11N02DL21-161
	143	32705	CM11N02DL21-161
4913997-7	17	02978	F401B04330
4914115-3	17	02978	F601B03051
4914116-1	17	02978	F601B04251
4914151-8	117	96151	8166
4914153-4	117	96151	211-1022-001
4914154-1	117	96151	5389-1
4914155-9	117	96151	8438
4914156-7	117	96151	8436-3
4914157-5	117	96151	6901-9
4914158-3	117	96151	7970
4914159-1	117	96151	5126
4914160-9	117	96151	8530
4914161-7	117	96151	6862
4914162-5	117	96151	18001
4914163-7	117	96151	8318
4914164-1	117	96151	15006
4914165-8	117	96151	15007
4914166-5	117	96151	14380
4914167-4	117	96151	8329
4914181-5	63	30612	
4914183-1	77	30612	
4914197-1	117	96151	204-1008-005
4914282-1	17	02978	F4U3002
4914283-9	117	96151	64418
4929288-9	157	30612	
4981084-9	101	63477	FC6019
4981104-5	45	78480	0W355
4981105-2	45	78480	0W352
4981106-0	45	78480	06096
4981107-8	45	78480	06137
4981108-6	45	78480	0W462
4981109-4	45	78480	0W446
4981110-2	45	78480	0W432
4981289-4	103	63477	FD470
4981290-2	103	63477	FC270
4981291-0	103	63477	FC725
4981292-8	103	63477	FC723
4981769-5	103	63477	FC11596
4981815-6	121	72210	S3589
4984141-4	101	63477	FD14422
4984142-2	101	63477	FC11476
4984152-9	101	63477	FC2108
4984153-9	101	63477	FC11143
4984155-4	101	63477	FC14297B
4984156-2	101	63477	FC2927E
4984157-0	101	63477	FC10901C
4984158-8	101	63477	FC11065C
4984159-6	101	63477	FC12103
4984201-6	101	63477	FC11301
4984504-3	87	97577	114-2116A
	87	30612	
4987572-7	107	02397	A3736U333

R

PART NO.	PAGE	VENDOR CODE	VENDOR PART NO.
987574-3	107	02397	372C133
987575-0	107	02397	177P94
4987578-4	107	97286	19366
4987579-2	107	02397	2758W23
987583-4	75	79410	T11-8
87585-9	75	79410	T12-7
987586-7	75	79410	T12-146
4987588-3	77	79410	T12-35
4987589-1	77	79410	4717C
4987590-9	77	79410	T11-147
4987593-3	75	79410	T12-12
4987595-8	77	79410	T11-116
4987596-6	77	79410	T12-150
4987597-4	77	79410	T12-149
4987600-6	75	79410	4806F
4987603-0	81	79410	4622C
4987609-7	81	79410	10-01-689-018
4987611-3	81	79410	T11-97
4987630-3	79	79410	T11-244
4987631-1	79	79410	10-01-156-003
4987634-5	79	79410	4868A
4987635-2	79	79410	T11-230
4987644-4	77	79410	AT11-195
4987673-3	79	79410	T11-223
4987702-0	75	79410	4824
987703-8	77	79410	4743B
987791-3	103	63477	FC4637
987792-1	103	63477	FC5353
4988062-8	79	79410	10-01-156-002
4991217-3	39	49234	1273A36-10
4991740-7	75	79410	4863A
4991741-2	75	79410	4868B
4991747-9	79	79410	T11-215
4992396-4	109	72210	S15081
4992397-2	109	30612	
4993823-6	129	11671	10566
4993825-0	129	11671	16AS2116
4994900-1	117	96151	15
4994901-9	117	96151	370
4994908-4	117	96151	20599
4995372-2	117	96151	844
4995382-1	117	96151	21144
4995383-9	117	96151	21141
4995592-5	75	79410	48060
4995594-1	75	79410	T11-17A
4995595-8	75	79410	T11-6B
995626-1	75	79410	4745F
95627-9	75	79410	B210AF6
96250-9	49	18265	P10-2144
4996251-7	49	18265	P10-1093
4996252-5	49	18265	P10-3008
4996254-1	49	18265	P10-2523
4996255-8	49	18265	P10-3007
4996438-0	81	79410	47374
4996464-6	49	18265	P2904
4997175-7	59	16764	1932197
4997176-5	59	16764	1958679
4997180-7	59	16764	1928021
4997181-5	59	16764	1928022
4997184-9	59	16764	9427815
4997587-3	77	79410	T11-33
4997977-6	129	11671	57-087-150-10L
4998176-4	166	30612	
4998178-0	166	30612	
4998612-8	166	30612	
4998673-0	81	79410	9409011
4998682-1	166	91561	50059-012
4998851-2	59	16764	1951567
4999280-3	81	79410	AT11-67A
4999354-6	75	79410	T11-98
4999355-3	75	79410	T11-99
4999539-2	81	79410	T12-48
4999620-0	166	30612	
4999621-8	166	30612	
4999827-1	129	11671	10835


30
1
38
2
3
29
4
36
21
28
35
32
5
33
34
31
6
7
25
24
27
23
22
8
26
20
13
15
13
19
14
12
9
16
17
10
11

770941-760314-1

T

CYLINDER BLOCK

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4908517-8	CAP-OIL FILLER	1	
2	4912140-3	OIL FILLER-CRANKCASE	1	
3	4908613-5	ROD-OIL GAUGE	1	
4	4908701-8	SUPPORT-ROD	1	
5	4891804-9	BLOCK-SHORT	1	SEE NOTE A
	4891803-1	ENGINE ASSY-SERVICE	1	SEE NOTE B
6	4909824-7	DOWEL-RING	1	
7	4909825-4	DOWEL-RING	1	
8	4908560-8	PLUG	5	
9	4908536-8	DOWEL	2	
10	4908618-4	CAP-FRONT BEARING	1	
11	4908640-8	BOLT-PLACE	2	
12	4908626-7	CAP-CENTER BEARING	1	
13	4908507-9	DOWEL	4	
14	4908537-6	BOLT-PLACE	4	
15	4908600-2	CAP-REAR BEARING	1	
16	4908538-4	*GASKET-COVER	1	
17	4912144-5	COVER-VALVE CHAMBER	1	
18	4908780-2	*GASKET-COPPER	2	
19	4908580-6	NUT	2	
20	4910070-4	STUD	2	
21	4908612-7	BAFFLE-REAR	1	
	4908611-9	BAFFLE-FRONT	1	
22	4908539-2	PLUG-SOCKET	4	
23	4908524-4	PLUG-RELIEF VALVE	1	
24	4908525-1	GASKET-COPPER	1	
25	4908526-9	SPRING-RELIEF VALVE	1	
26	4908578-0	WASHER-SPACING	*	USE AS REQUIRED
27	4908519-4	PLUNGER-RELIEF VALVE	1	
28	0910014-0	PLUG-EXPANSION-.50"	1	
29	0910005-8	PLUG-EXPANSION-1.12"	1	
30	0910007-4	PLUG-EXPANSION-1.38"	2	
31	4814364-8	SENDER-OIL PRESSURE	1	
	0917365-9	LOCKWASHER-#10	1	
	0917415-2	NUT-#10-32	1	
	0917032-5	ADAPTER-.12"-27	2	
32	0923690-2	ELBOW-90°-.12"-27	1	
33				
34				
35	4908595-4	STUD-ALTERNATOR BRACKET	2	
36	0914383-5	SETSCREW-PLUGGING-.38"-16 X .50"	1	
37	0912319-1	COCK-DRAIN-.25"	1	NOT ILLUSTRATED
38	4908784-3	STUD-OIL FILLER	2	

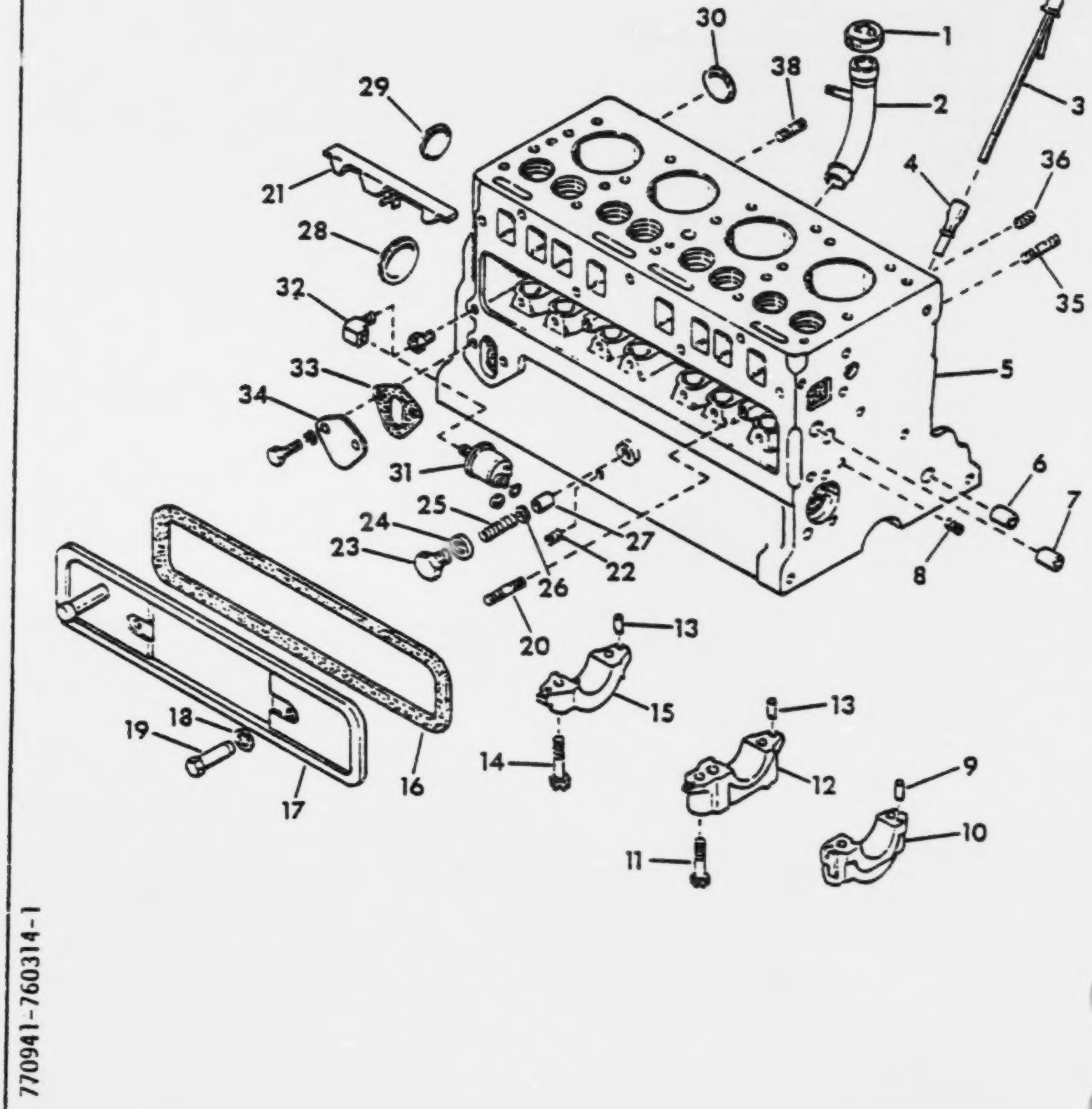
*INCL IN KIT 4908685-3

770941-760314-1

CONTINUED

best copy available

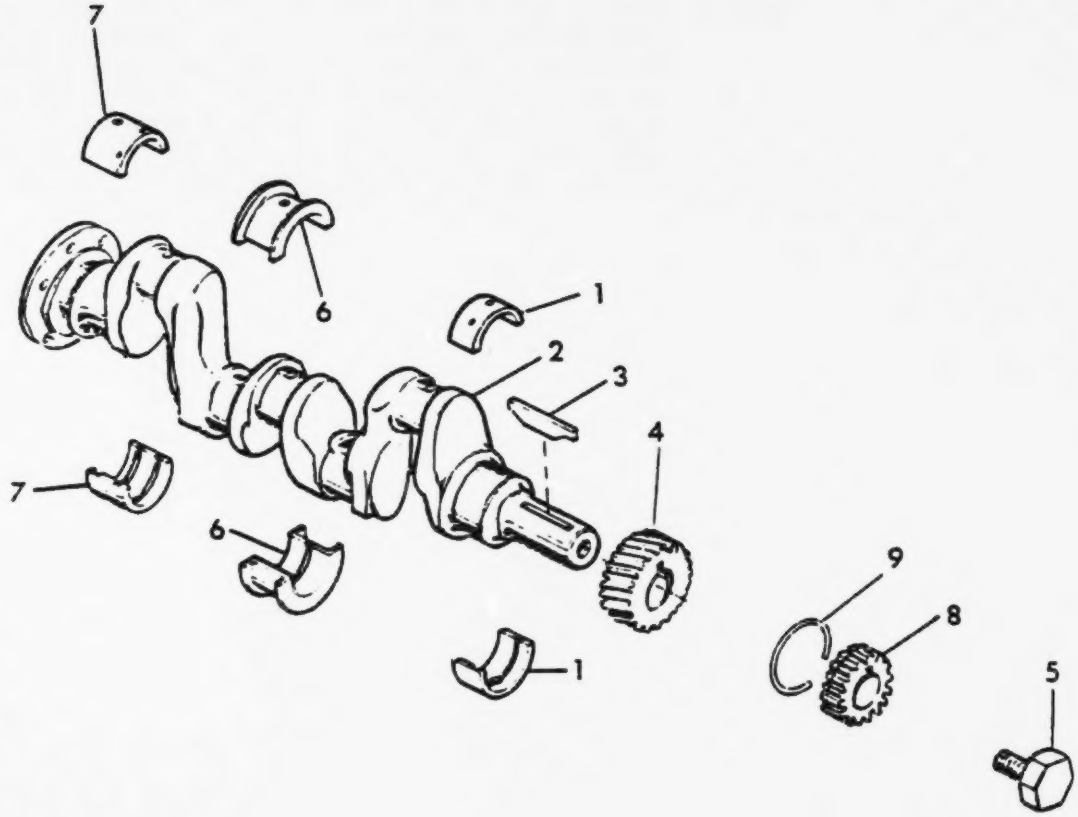
Reproduced from poor document.


770941-760314-1

CYLINDER BLOCK (CONTINUED)

NOTE A: SHORT BLOCK ASSY INCLUDES: CYLINDER BLOCK-CONNECTING RODS - CAMSHAFT BUSHINGS - BEARING CAPS - VALVE TRAIN - CAMSHAFT - MAIN AND ROD BEARINGS - CRANKSHAFT - PISTON - PISTON PINS - PISTON RINGS - FRONT END PLATE - THRUST PLATE - CAM GEARS - CRANKSHAFT GEAR - OIL GAUGE ROD SUPPORT - GAUGE ROD - FUEL PUMP HOLE COVER - OIL GUARD - REAR BEARING AND SERVICE GASKET SET

NOTE B: SERVICE ENGINE ASSY INCLUDES: CYLINDER AND CRANKCASE BEARING CAPS - GUIDES - INSERTS - COMPLETE VALVE MECHANISM - SUPPORTS - PISTONS AND RINGS - CONNECTING RODS - CRANKSHAFT - CAMSHAFT - FRONT END PLATE - GEARS - FILLER BLOCKS - CYLINDER HEAD - GASKETS - GEAR COVER - OIL PUMP - OIL PAN - STUDS - NUTS - SCREWS - WASHERS - PINS AND PLUGS.

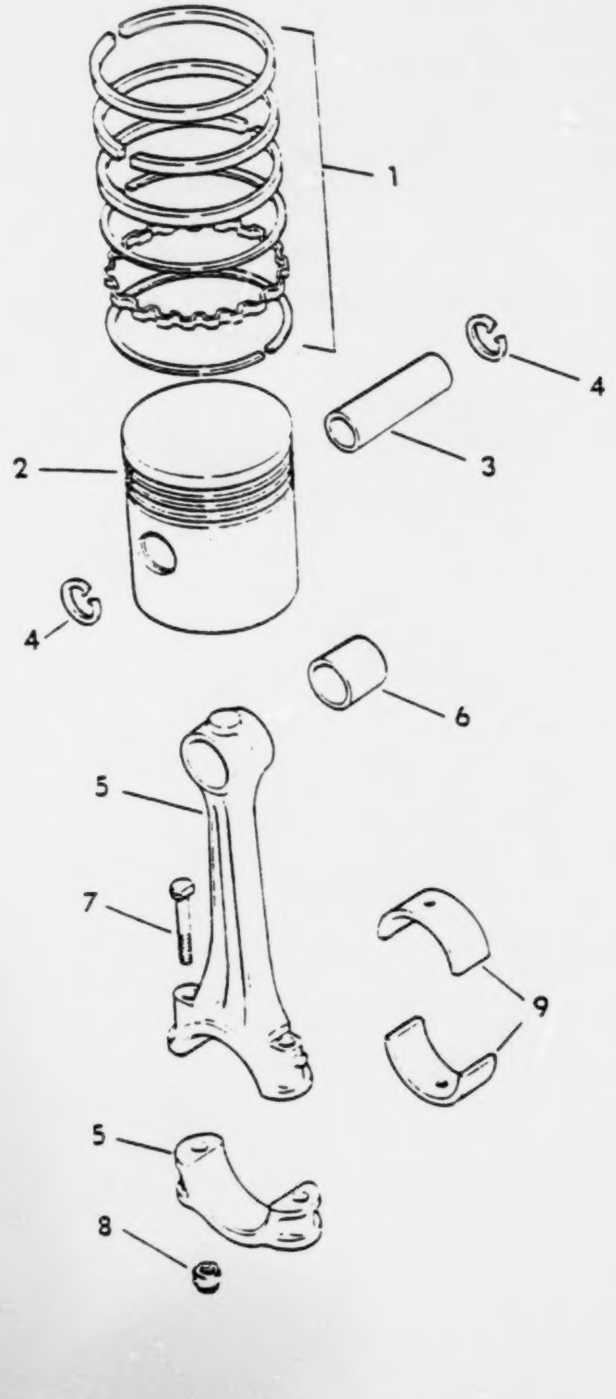

7
6
1
2
3
4
7
6
9
8
1
5

750317-74115-1

CRANKSHAFT

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4908641-6	*BEARING-FRONT MAIN-UPPER & LOWER	1	STANDARD
2	4908628-3	CRANKSHAFT	1	
3	4908563-2	KEY-CRANKSHAFT GEAR	1	
4	4910030-8	GEAR-CRANKSHAFT	1	
5	4909764-5	SCREW-RETAINING	1	
6	4908647-3	*BEARING-CENTER MAIN-UPPER & LOWER	1	STANDARD
7	4908653-1	*BEARING-REAR MAIN-UPPER & LOWER	1	STANDARD
8	4909762-9	COUPLING	1	
9	4909763-7	RING-RETAINER	1	

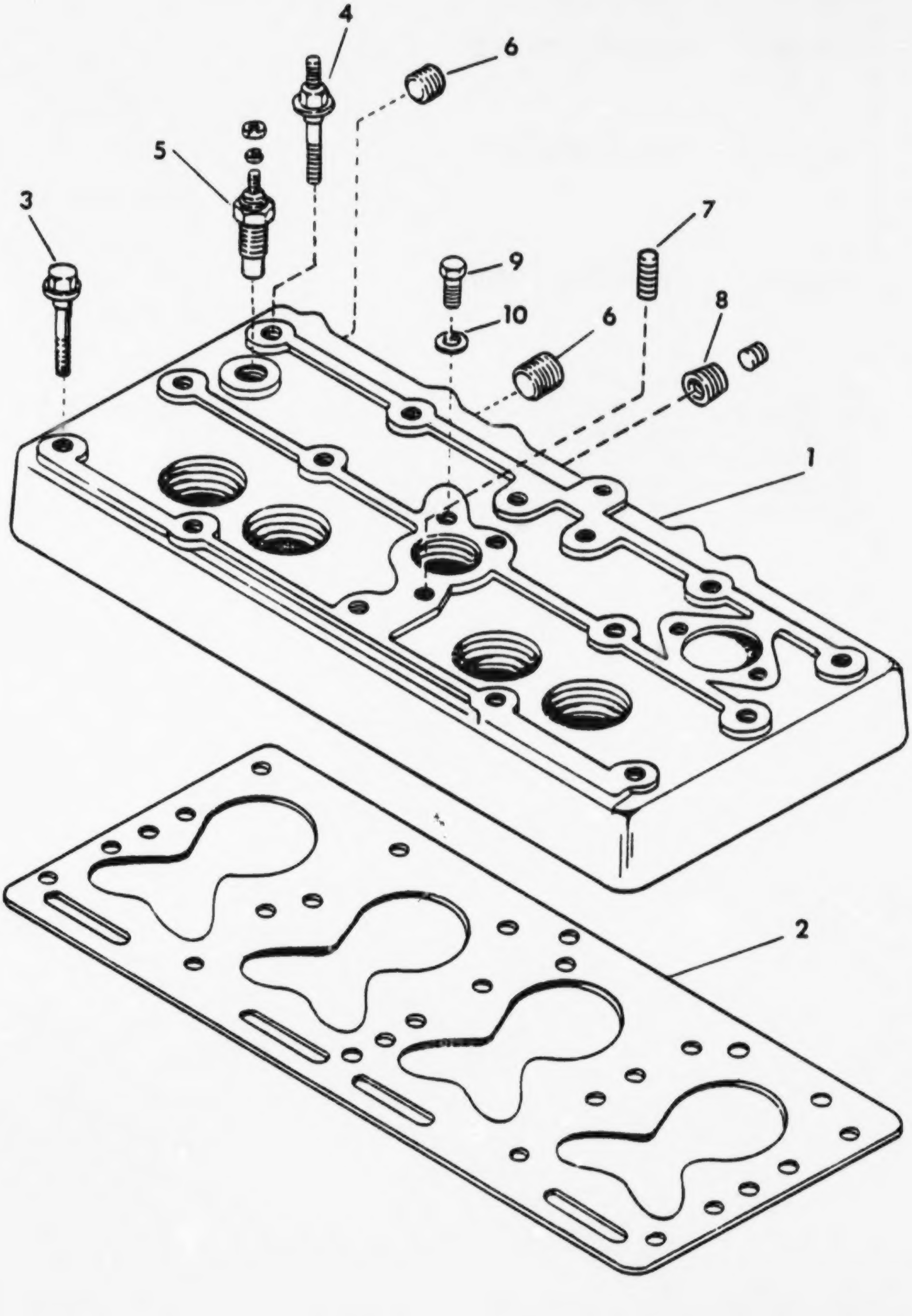
*INCL IN KIT 4908666-3


1
4
3
2
4
6
5
7
9
5
8

74114

PISTON AND CONNECTING ROD

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4909800-7	RING-SET-STANDARD	1	RING SET SERVICES ONE ENGINE
2	4912747-5	PISTON-STANDARD	4	INCL ITEM 3 & 4
3	4908565-7	PIN-PISTON-STANDARD	4	
4	4912748-3	RING-RETAINER	8	
5	4909783-5	ROD ASSY-CONNECTING	4	INCL ITEM 6-7 & 8
6	4908505-3	BUSHING-CONN ROD	4	
7	4908564-0	BOLT-CONN ROD	8	
8	4908504-6	NUT-CONN ROD BOLT	8	
9	4909786-8	BRG KIT-CONN ROD-STANDARD	1	

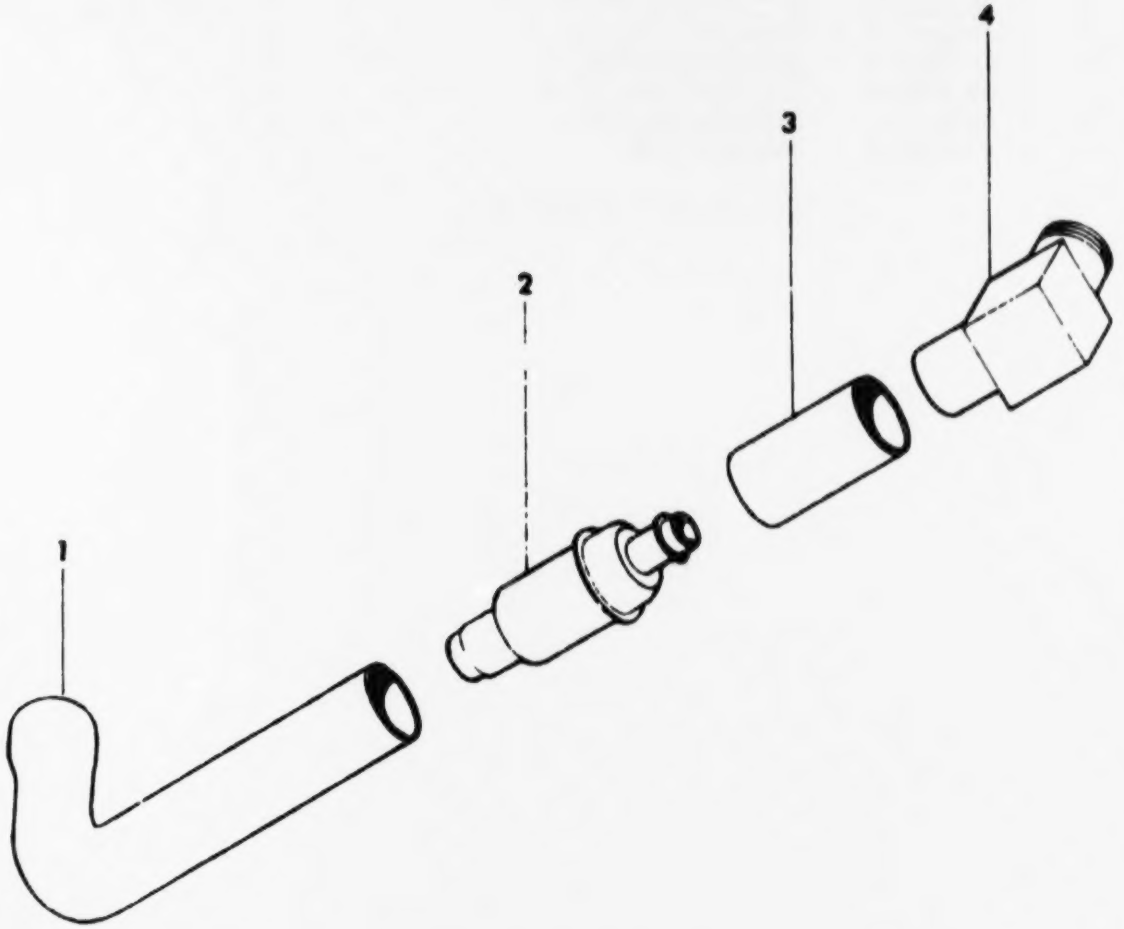

4
6
5
3
7
9
8
10
6
1
2

750319-74116-1

CYLINDER HEAD

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4909782-7	HEAD ASSY-CYLINDER	1	INCL ITEMS 6-9-10
2	4908585-5	*GASKET-CYLINDER HEAD	1	
3	4908604-4	CAPSCREW-CYLINDER HEAD	11	
4	4908605-1	CAPSCREW-CYLINDER HEAD	4	EXTENDED
5	4760149-7	SENDER-WATER TEMPERATURE	1	
	0917365-9	LOCKWASHER-#10	1	
	0917415-2	NUT-#10-32	1	
6	0924085-4	PLUG-PIPE-.50"-14	2	LEFT SIDE
7	4908595-4	STUD-DISTRIBUTOR	1	
8	4909829-6	BUSHING-REDUCER	1	
	0918887-1	PLUG-PIPE-.38" PT	1	
9	4908592-1	CAPSCREW-PLUGGING	1	
10	4908593-9	WASHER-PLAIN	1	

*INCL IN KIT 4908685-3

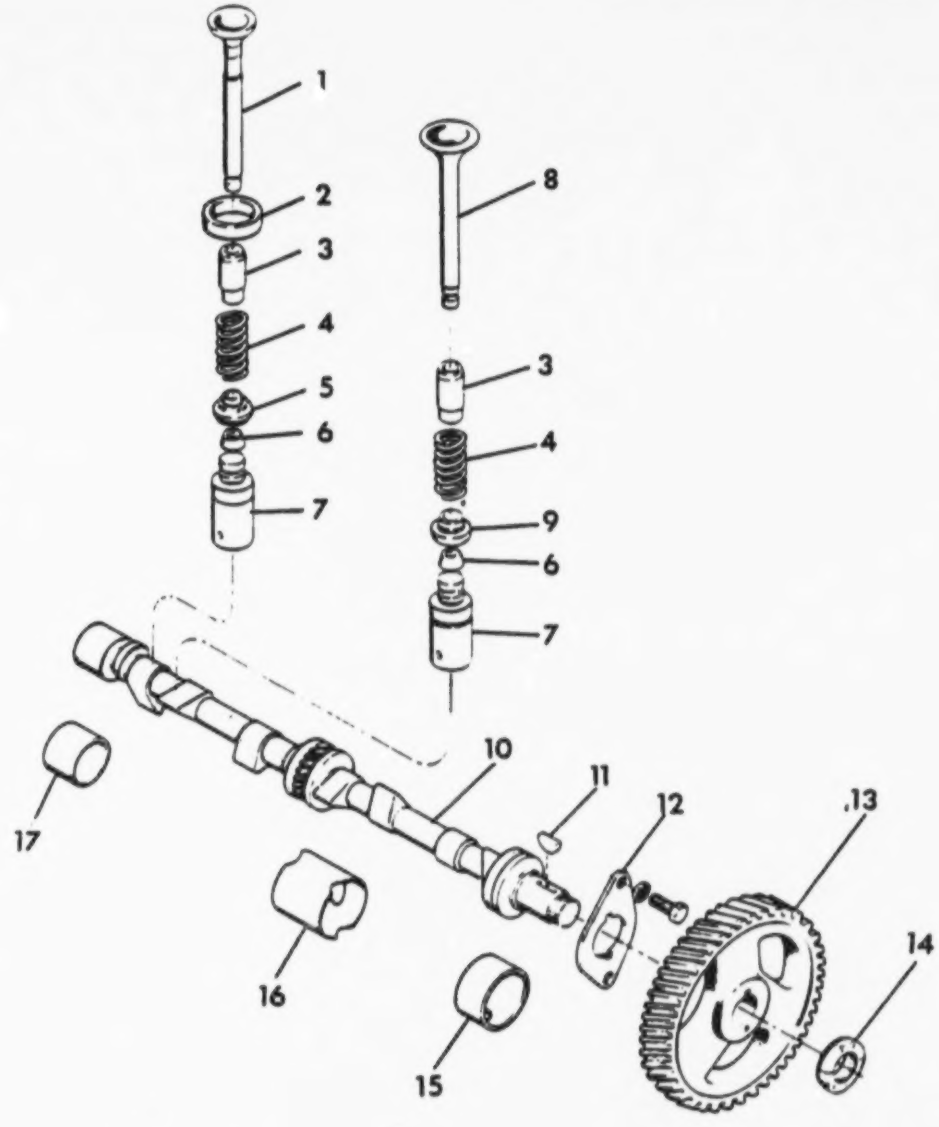


74117

CRANKCASE VENTILATION

ITEM	PART NO.	DESCRIPTION	QTY.
1	4908520-2	HOSE	1
2	4908523-6	VALVE-PCV	1
3	4908521-0	HOSE	1
4	4908522-8	ELBOW- 90°	1

74117

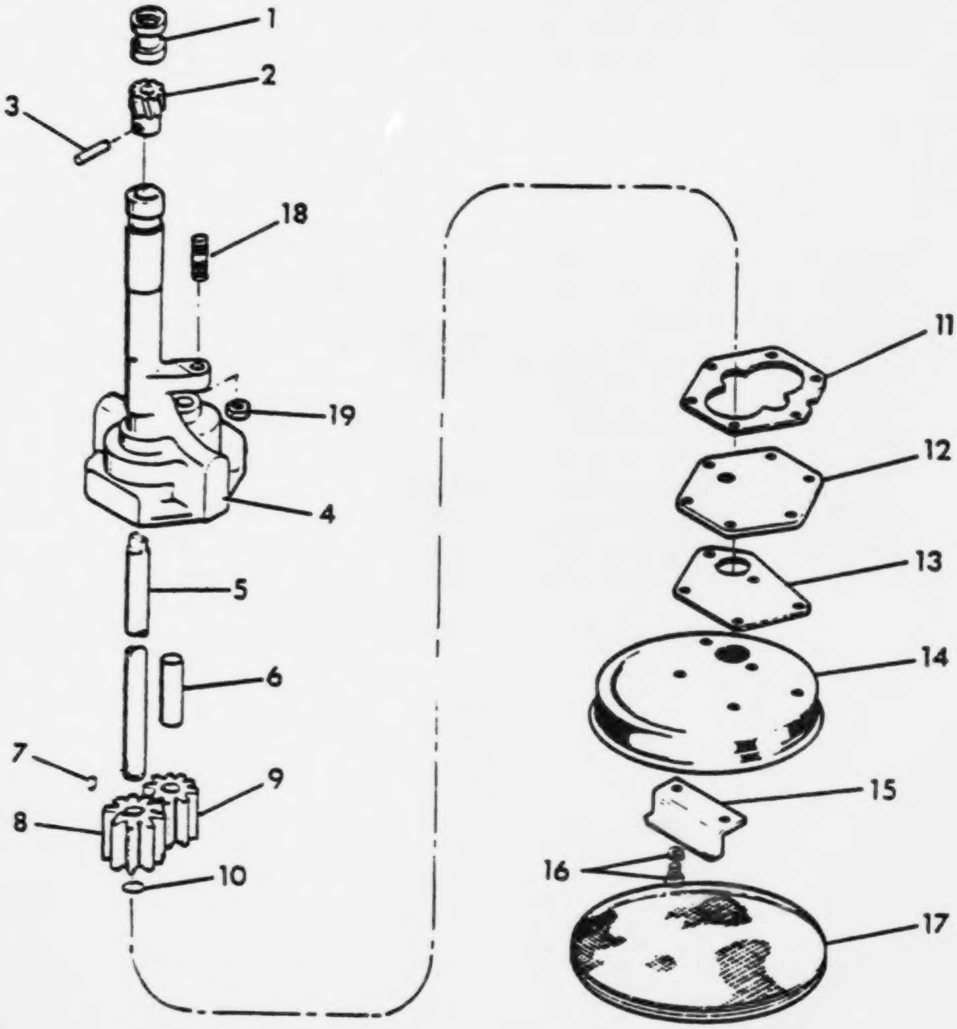

1
2
3
4
5
6
7
8
3
4
9
6
7
10
11
12
13
14
15
16
17

74118

VALVE MECHANISM

ITEM	PART NO.	DESCRIPTION	QTY.
1	4908609-3	VALVE-EXHAUST	4
2	4908514-5	INSERT-VALVE SEAT-EXHAUST	4
3	4908513-7	GUIDE-VALVE STEM	8
4	4908512-9	SPRING-VALVE	8
5	4908562-4	ROTOCOIL-EXHAUST	4
6	4908574-9	LOCK-VALVE SPRING RETAINER	16
7	4908515-2	TAPPET-VALVE-STANDARD	8
8	4908607-7	VALVE-INTAKE	4
9	4908575-6	RETAINER-VALVE SPRING-INTAKE	4
10	4910258-5	CAMSHAFT-STEEL	1
11	4908569-9	KEY-CAMGEAR TO CAMSHAFT	1
12	4908566-5	PLATE-CAMSHAFT THRUST	1
	0916803-0	LOCKWASHER-.31"	2
	0925205-7	CAPSCREW-.31"-18 X .62"	2
13	4910032-4	GEAR-CAMSHAFT	1
14	4908590-5	NUT-CAMGEAR TO CAMSHAFT	1
15	4908568-1	*BUSHING-CAMSHAFT-FRONT	1
16	4908502-0	*BUSHING-CAMSHAFT-CENTER	1
17	4908501-2	*BUSHING-CAMSHAFT-REAR	1

*INCL IN KIT 4908690-3

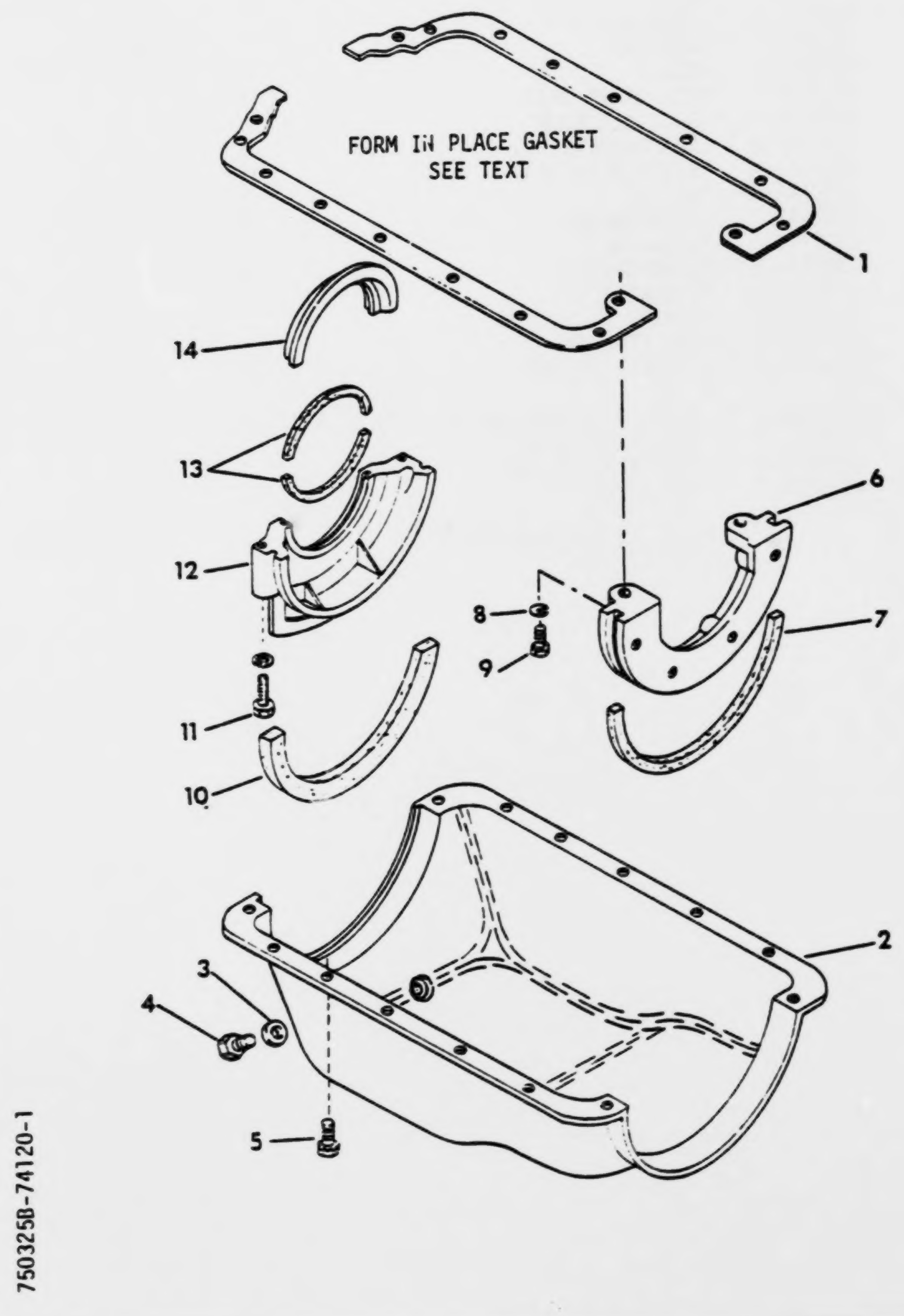

1
2
3
18
4
19
5
6
7
9
8
10
11
12
13
14
15
16
17

751212-74119-1

OIL PUMP

ITEM	PART NO.	DESCRIPTION	QTY.	
-	4909780-1	PUMP ASSY-OIL	1	INCL ITEMS 2 THRU 17
1	4908511-1	BUSHING	1	IN CYLINDER BLOCK
2	4909793-4	*GEAR	1	
3	4908747-1	*PIN-DRIVE GEAR	1	
4	4908746-3	BODY-OIL PUMP	1	
5	4908510-2	SHAFT-DRIVE	1	
6	4908699-4	STUD-IDLER GEAR	1	
7	4908745-5	*KEY	1	
8	4908742-2	*GEAR-DRIVER	1	
9	4908741-4	*GEAR-IDLER	1	
10	4908744-8	*RING-RETAINER	1	
11	4908748-9	*GASKET-COVER	1	
12	4908749-7	COVER	1	
13	4908751-3	*GASKET-FRAME	1	
14	4908750-5	FRAME-STRAINER	1	
15				
16	0928588-3	SCREW & LOCKWASHER-.25"-20 X .62"	6	
17	4908712-5	SCREEN-STRAINER	1	
18	4908703-4	STUD-BEARING CAP	1	
19	4910078-7	NUT-STUD	1	

*INCL IN KIT 4909779-3

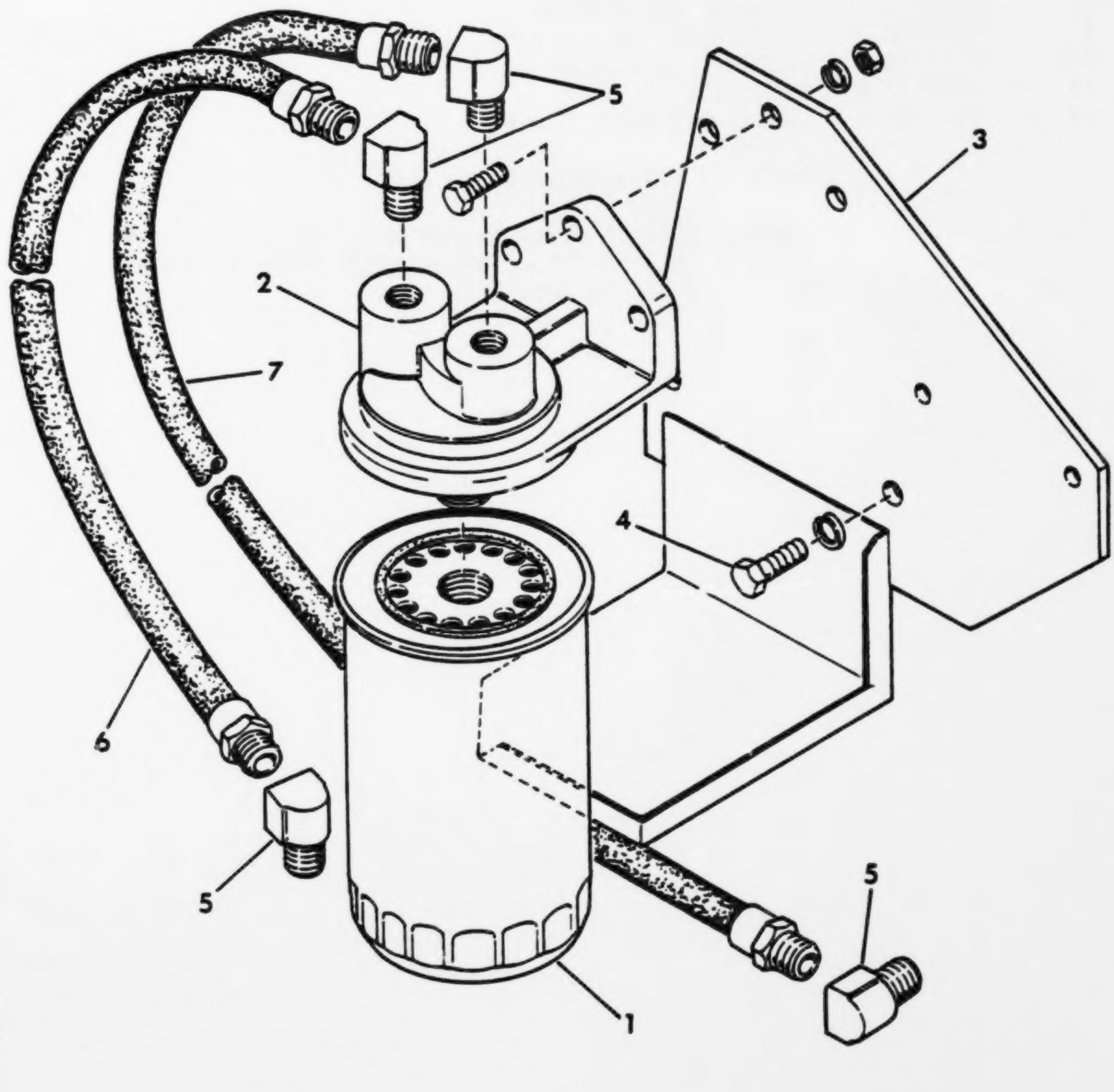

FORM IN PLACE GASKET
SEE TEXT
750325B-74120-1

OIL PAN

ITEM	PART NO.	DESCRIPTION	QTY.	
1	---------	*GASKET-OIL PAN	#	SEE NOTE
2	4913997-7	PAN-OIL	1	INCL ITEMS 3 & 4
3	4912201-3	*WASHER-DRAIN PLUG	1	
4	4912200-5	PLUG-OIL DRAIN	1	
5	0918793-1	CAPSCREW-.31"-18 X .62"	14	INCL WASHER
6	4914115-3	BLOCK-FILLER-FRONT	1	
7	4908714-1	*GASKET-FILLER BLOCK	1	
8	0910941-4	LOCKWASHER-.31"	4	
9	4908581-4	SCREW-.31"-18 X .88"	2	
10	4908714-1	*GASKET-FILLER BLOCK	1	
11	4908596-2	SCREW-.31"-18 X 2.63"	2	
12	4914116-1	BLOCK-FILLER-REAR	1	
13	4908715-8	*SEAL-OIL	2	
14	4908602-8	GUARD-OIL-REAR BEARING	1	

*INCL IN KIT 4914282-1

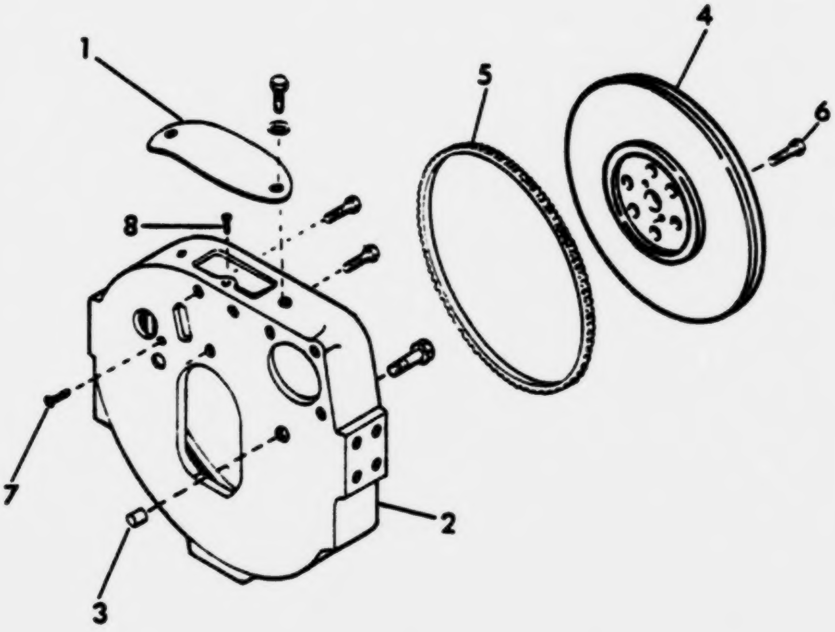
NOTE - FORM IN PLACE GASKET MATERIAL IS AVAILABLE
IN 4.50 C.C. TUBES - ORDER PART NO. 4914117-9
USE AS REQUIRED



790241-790240-1

OIL FILTER

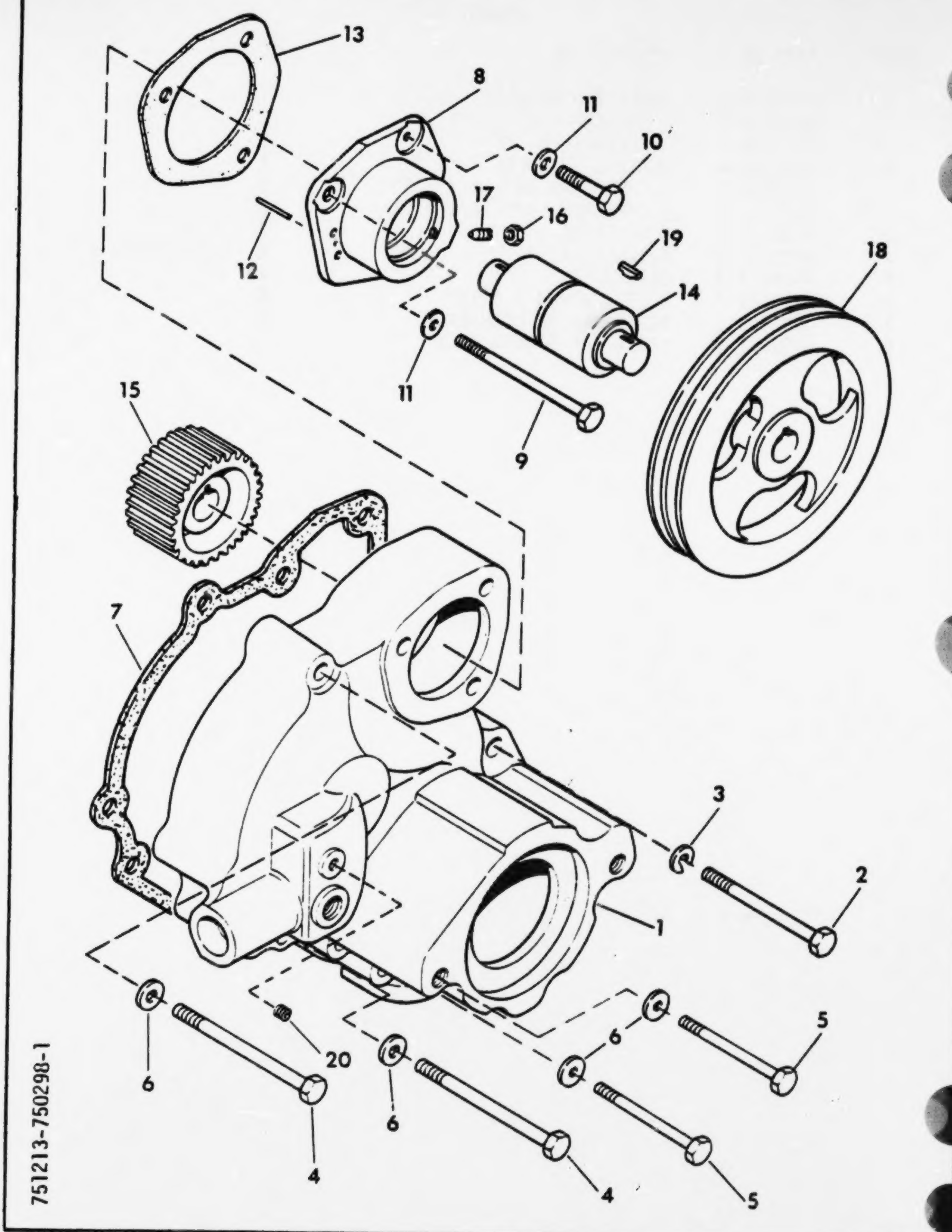
ITEM	PART NO.	DESCRIPTION	QTY.
1	4910775-8	FILTER	1
2	4910777-4	BASE-FILTER	1
	0910941-8	LOCKWASHER	3
	4910780-8	CAPSCREW	3
	0917372-5	NUT	3
	4910776-6	NIPPLE	1
3	4910807-9	BRACKET-FILTER	1
4	0915809-8	CAPSCREW	2
	4910779-0	WASHER	2
	0910941-4	LOCKWASHER	2
5	4910781-6	ELBOW	4
6	4910784-0	HOSE	1
7	4910785-7	HOSE	1



750353-74122-1

FLYWHEEL AND HOUSING
POWER SHIFT

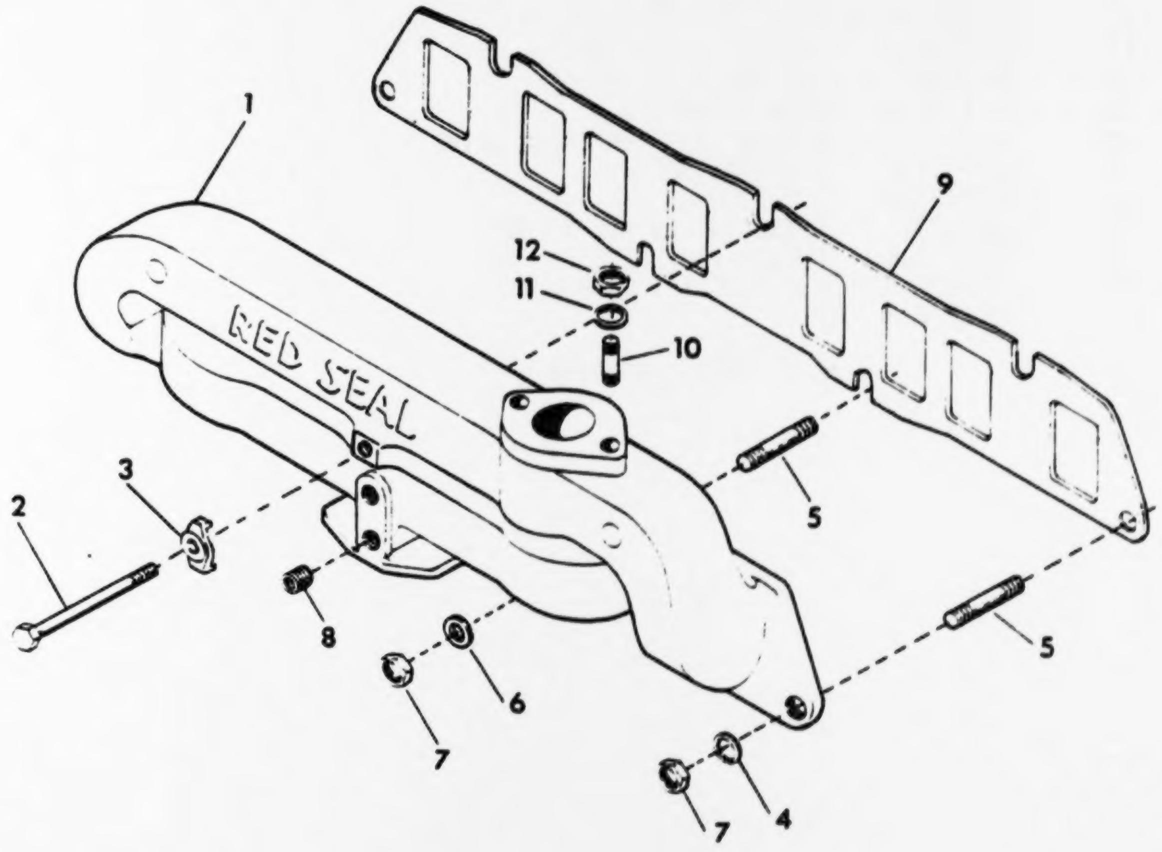
ITEM	PART NO.	DESCRIPTION	QTY.	
1	4908615-0	COVER-TIMING HOLE	1	
	0921958-5	CAPSCREW-.25"-20 X .5"	2	
	0924958-2	LOCKWASHER-.25"	2	
2	4909788-4	HOUSING-FLYWHEEL	1	
	0921212-7	CAPSCREW-.44"-14 X 1.5"	2	
	0921876-9	CAPSCREW-.44"-14 X 1.12"	3	
3	4908576-4	DOWEL-RING	2	
4	4909767-8	FLYWHEEL ASSY	1	INCL ITEM 5
5	4908614-3	GEAR-RING	1	
6	4910075-3	BOLT-.38"-24 X 1.19"	6	
7	4808509-5	SCREW-TIMING POINTER	1	
8	4909832-0	SCREW-TOP TIMING HOLE	1	


751213-750298-1

GEAR COVER

ITEM	PART NO.	DESCRIPTION	QTY.
1	4909639-9	COVER-GEAR-FRONT	1
2	0924346-0	CAPSCREW-.44"-14 X 2.5"	1
3	0918199-1	LOCKWASHER-.44"	1
4	0921973-4	CAPSCREW-.38"-16 X 2.75"	2
5	0922130-0	CAPSCREW-.38"-16 X 2.25"	4
6	0916965-7	LOCKWASHER-.38"	6
7	4909794-2	*GASKET-COVER	1
8	4909771-0	ADAPTOR-FAN-DRIVE	1
9	0919953-0	CAPSCREW-.38"-16 X 3.12"	2
10	4909820-5	CAPSCREW-.38"-16 X 1"	1
11	0917264-2	WASHER-COPPER-.38"	3
12	0918547-1	PIN-ROLL-.12" X .56"	1
13	4909774-4	*GASKET-ADAPTOR	1
14	4909772-8	BEARING AND SHAFT-FAN DRIVE	1
15	4910031-6	GEAR-FAN DRIVE	1
16	4909823-9	NUT-.25"-20	1
17	4909822-1	SETSCREW-.25"-20 X .62"	1
18	4909773-6	PULLEY-FAN DRIVE	1
19	4909827-0	KEY-PULLEY & GEAR	2
20	4908560-8	PLUG	1

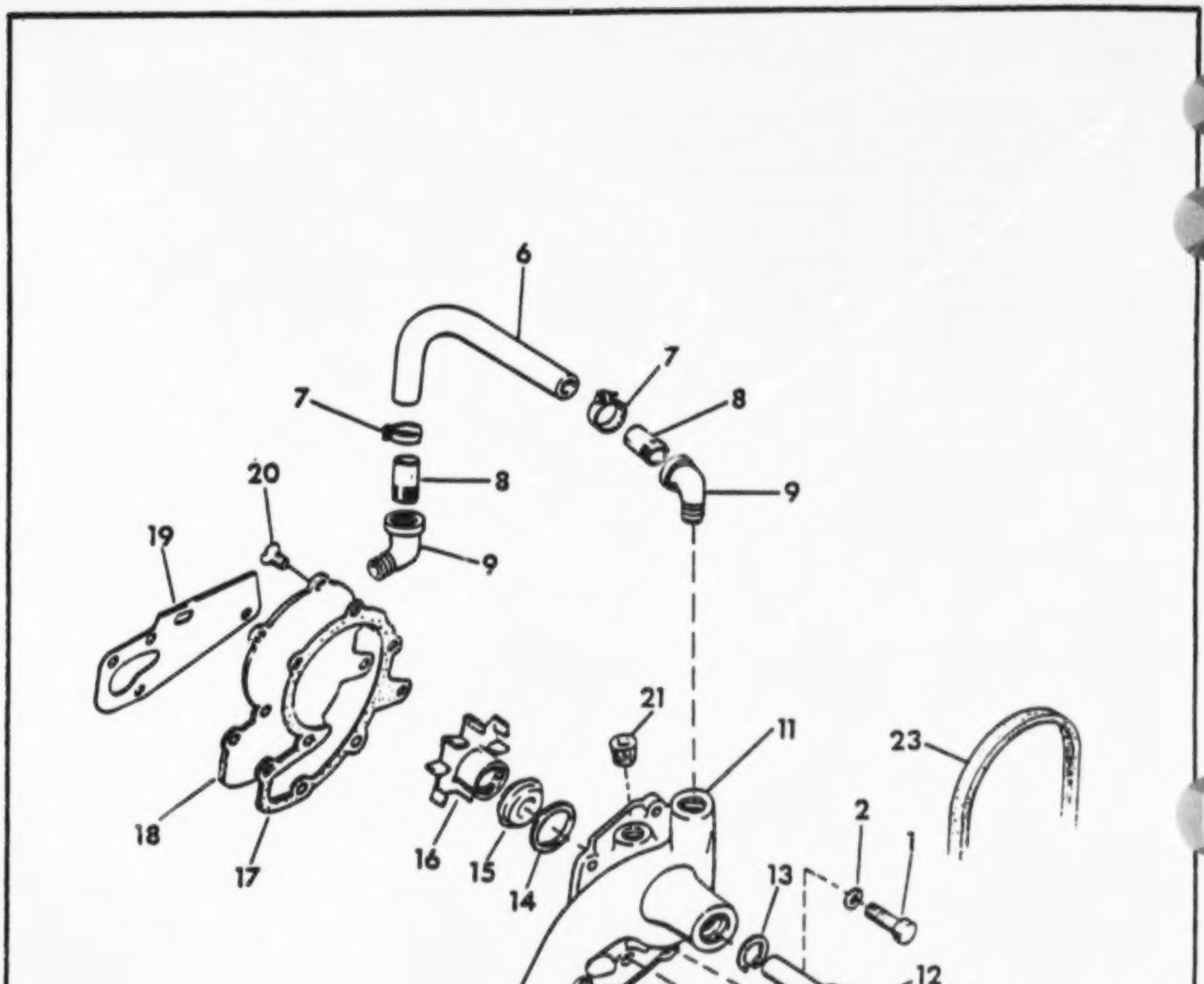
*INCL IN KIT 4909766-0


RED SEAL
750323-750322-1

INTAKE & EXHAUST MANIFOLD

ITEM	PART NO.	DESCRIPTION	QTY.
1	4909768-6	MANIFOLD-INT & EXH	1
2	4909826-2	SCREW-.38"-16 X 4.50"	1
3	4909817-1	CLAMP-MANIFOLD	1
4	4908586-3	WASHER-.38"	2
5	4908518-6	STUD-.38"-16 X 1.75"	6
6	0929362-2	WASHER-.41"	4
7	0916954-1	NUT-.38"-16	6
8	4908560-8	PLUG-.25" PT	1
9	4908786-9	*GASKET	1
10	4908518-6	STUD-.38"-16 X 1.62"	2
11	4908586-3	WASHER-.38"	2
12	0916954-1	NUT-.38"-16	2

*INCL IN KIT 4908685-3

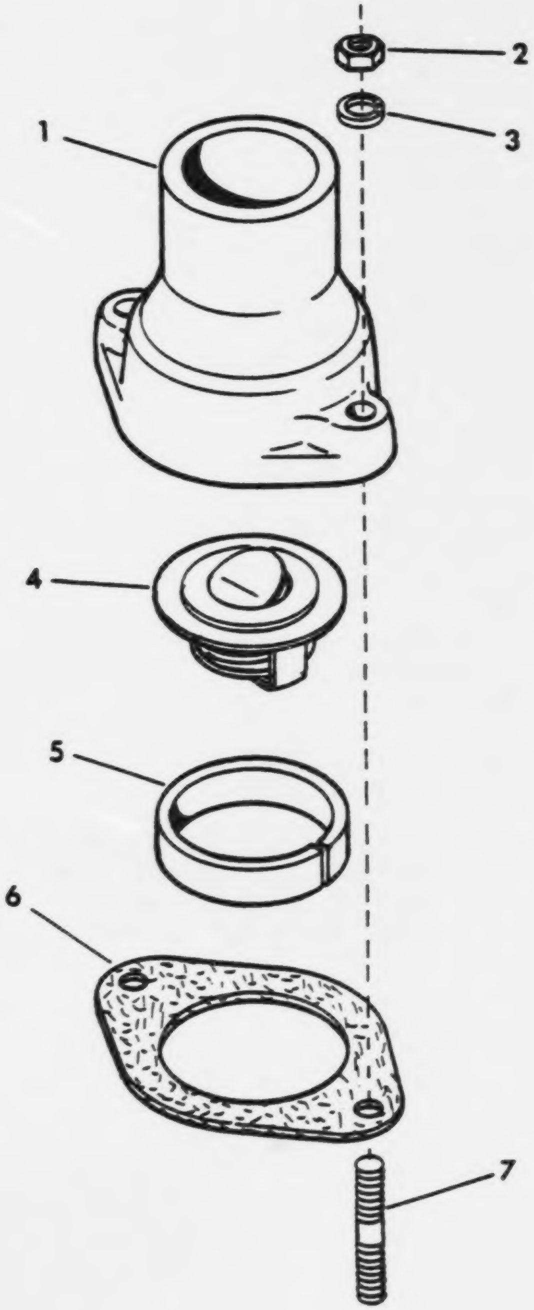

770844-74126-1

WATER PUMP

ITEM	PART NO.	DESCRIPTION	QTY.	
-	4909776-9	PUMP ASSY-WATER	1	INCL ITEMS 11 THRU 21
1	0921972-6	CAPSCREW-.38"-16 X 2.50"	2	
2	0916965-7	LOCKWASHER-.38"	2	
3	0919958-9	CAPSCREW-.38"-16 X 1.88"	2	
4	0929362-2	WASHER-.38"	1	
5	4908593-9	WASHER-.38"	1	
6	4909819-7	HOSE-BY-PASS	1	
7	0928017-3	CLAMP-HOSE	2	
8	4908530-1	NIPPLE	2	
9	0916735-4	ELBOW-90°-.38"	2	
10	4909777-7	PULLEY-DRIVE	1	SEE NOTE
11	---------	BODY-PUMP	1	ORDER ASSY
12	4908753-9	*BEARING AND SHAFT	1	
13	4908782-8	*RING-RETAINING	2	
14	4908759-6	*GASKET-SEAL	1	
15	4908754-7	*SEAL	1	
16	4909797-5	*IMPELLER	1	
17	4909833-8	*GASKET-PLATE TO BODY	1	
18	4909834-6	PLATE-BACK	1	
19	4909795-9	#*GASKET-PUMP TO CRANKCASE	1	SEE NOTE
20	4908783-6	SCREW	4	
21	4908781-0	PLUG-PIPE-.38"	1	
22	4856601-2	FAN	1	
	0921332-3	CAPSCREW-.31"-18 X .75"	4	
	0917356-8	LOCKWASHER-.31"	4	
23	4856615-2	BELT-FAN	1	

*INCL IN KIT 4909778-5
#INCL IN KIT 4909766-0

NOTE INSTALLATION INSTRUCTIONS PACKAGED WITH SERVICE PUMP MUST BE FOLLOWED WHEN ASSEMBLING PULLEY TO PUMP

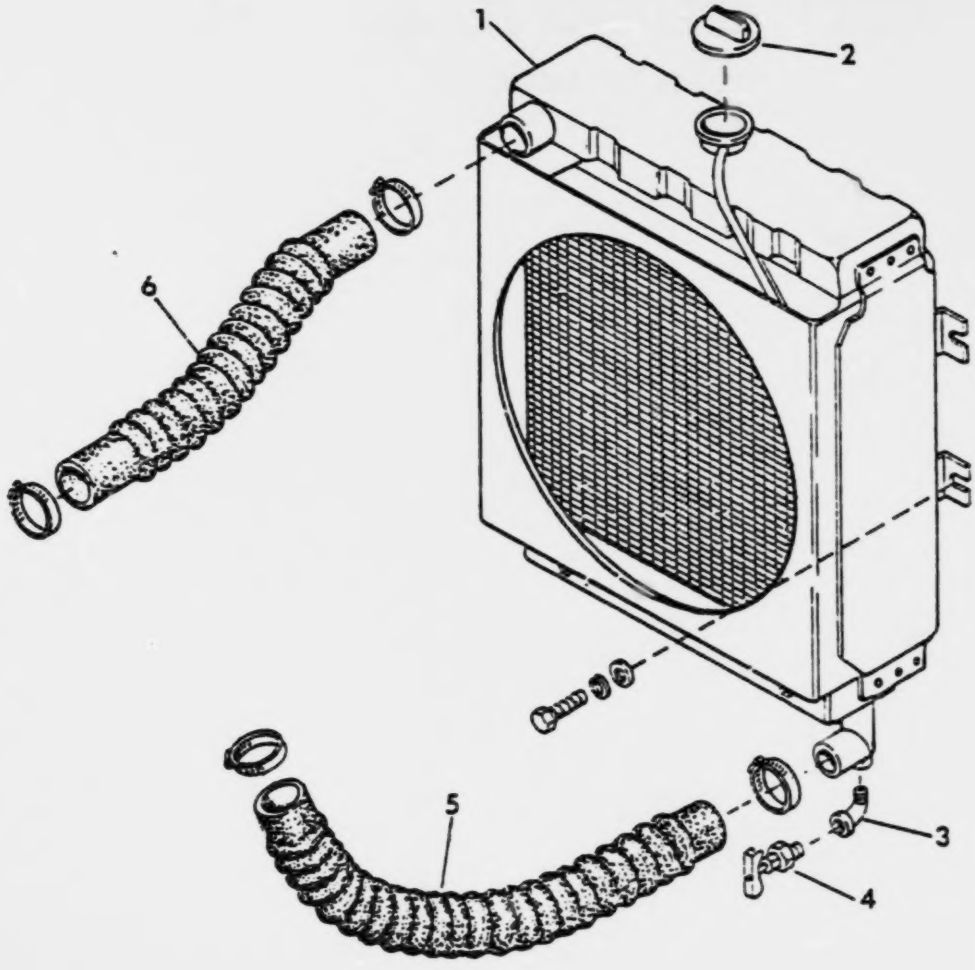


751224-751223-1

THERMOSTAT & HOUSING

ITEM	PART NO	DESCRIPTION	QTY.
1	4909818-9	ELBOW-WATER OUTLET	1
2	0917372-5	NUT-.31"-18	2
3	0910941-4	LOCKWASHER-.31"	2
4	4908710-9	THERMOSTAT-180°	1
5	4908625-9	RING-THERMOSTAT ADAPTER	1
6	4908588-9	*GASKET	1
7	4909821-3	STUD-.31"-18 x 2.25"	2
8	4908534-3	CAPSULE-COOLANT CONDITIONER	2

*INCL IN KIT 4908685-3

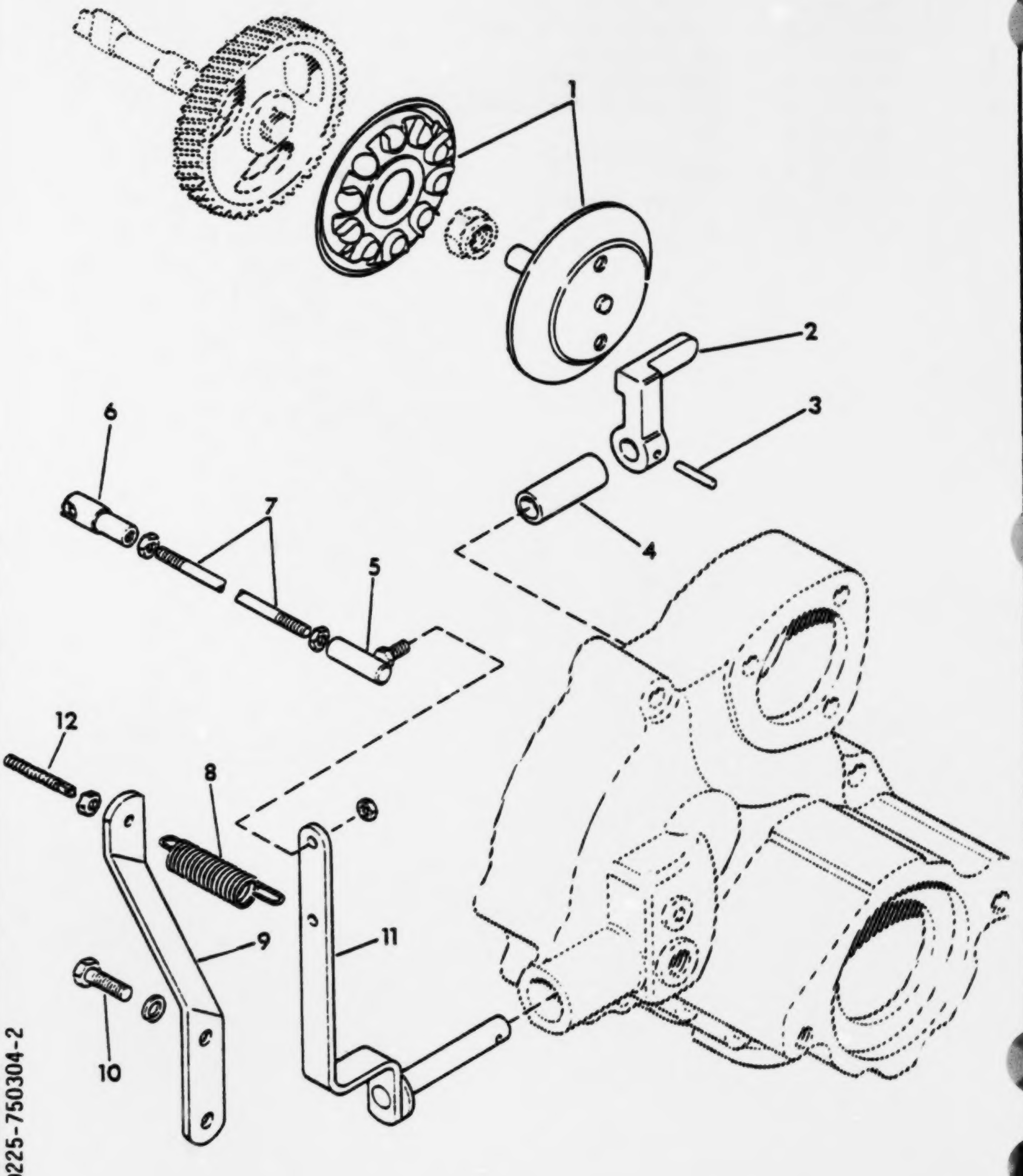


770827-750350-1

RADIATOR-POWER SHIFT

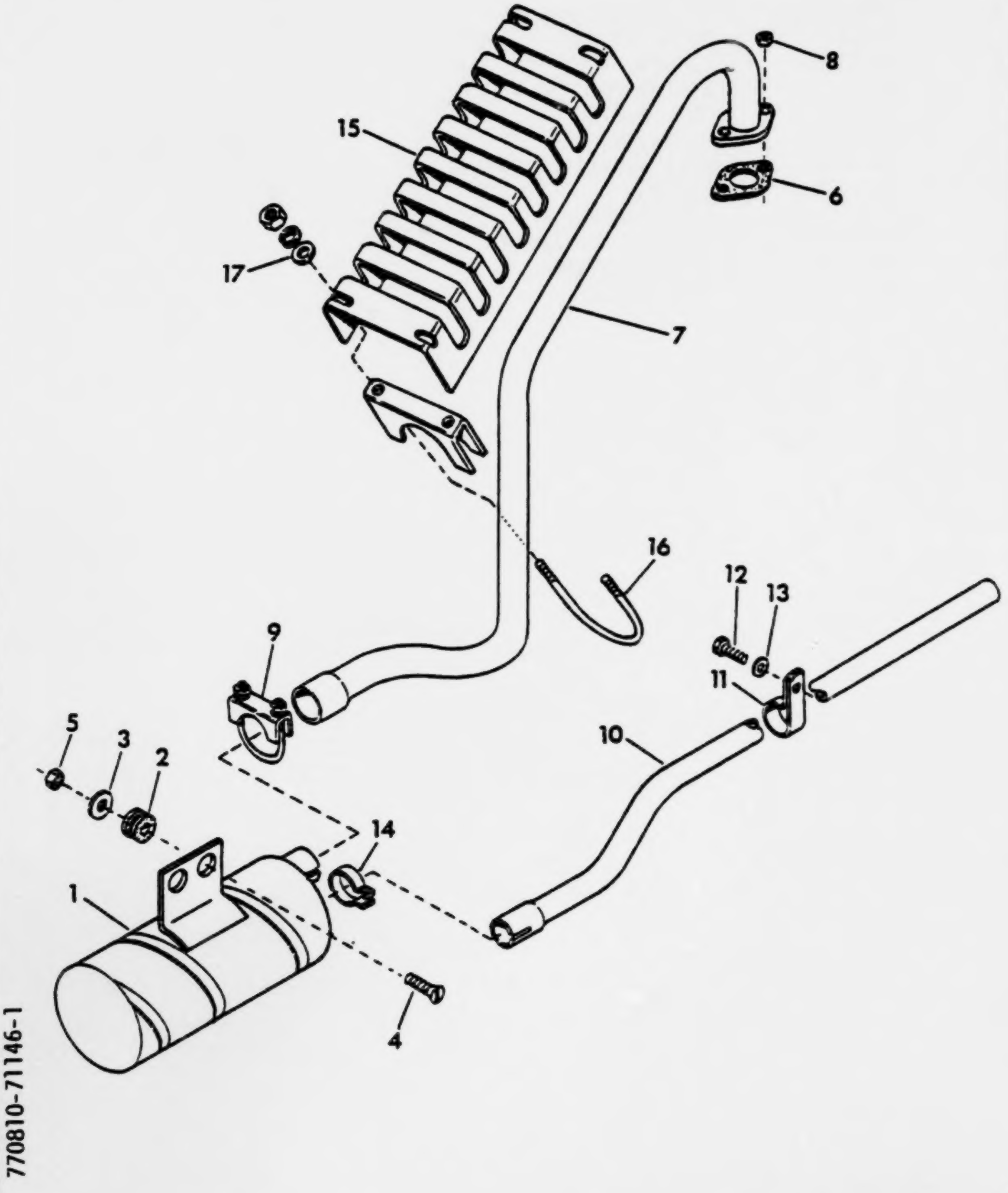
ITEM	PART NO.	DESCRIPTION	QTY		
1	4882936-0	RADIATOR	1		INCL ITEM 2
	0921965-0	CAPSCREW-.38"-16 X .75"	2		
	0916965-7	LOCKWASHER-.38"	2		
	0922153-2	WASHER-.41" X .88"	2		
2	4908156-5	CAP-RADIATOR	1	7#	
3	0915399-0	ELBOW-PIPE-BRASS-.12"	1		
4	0914453-6	COCK-DRAIN-PIPE-BRASS-.12"	1		
5	4858197-9	HOSE	1		
	4253456-0	CLAMP-SAE #24	2		
6	4858198-7	HOSE	1		
	4253456-0	CLAMP-SAE #24	2		

770827-750350-1


780225-750304-2

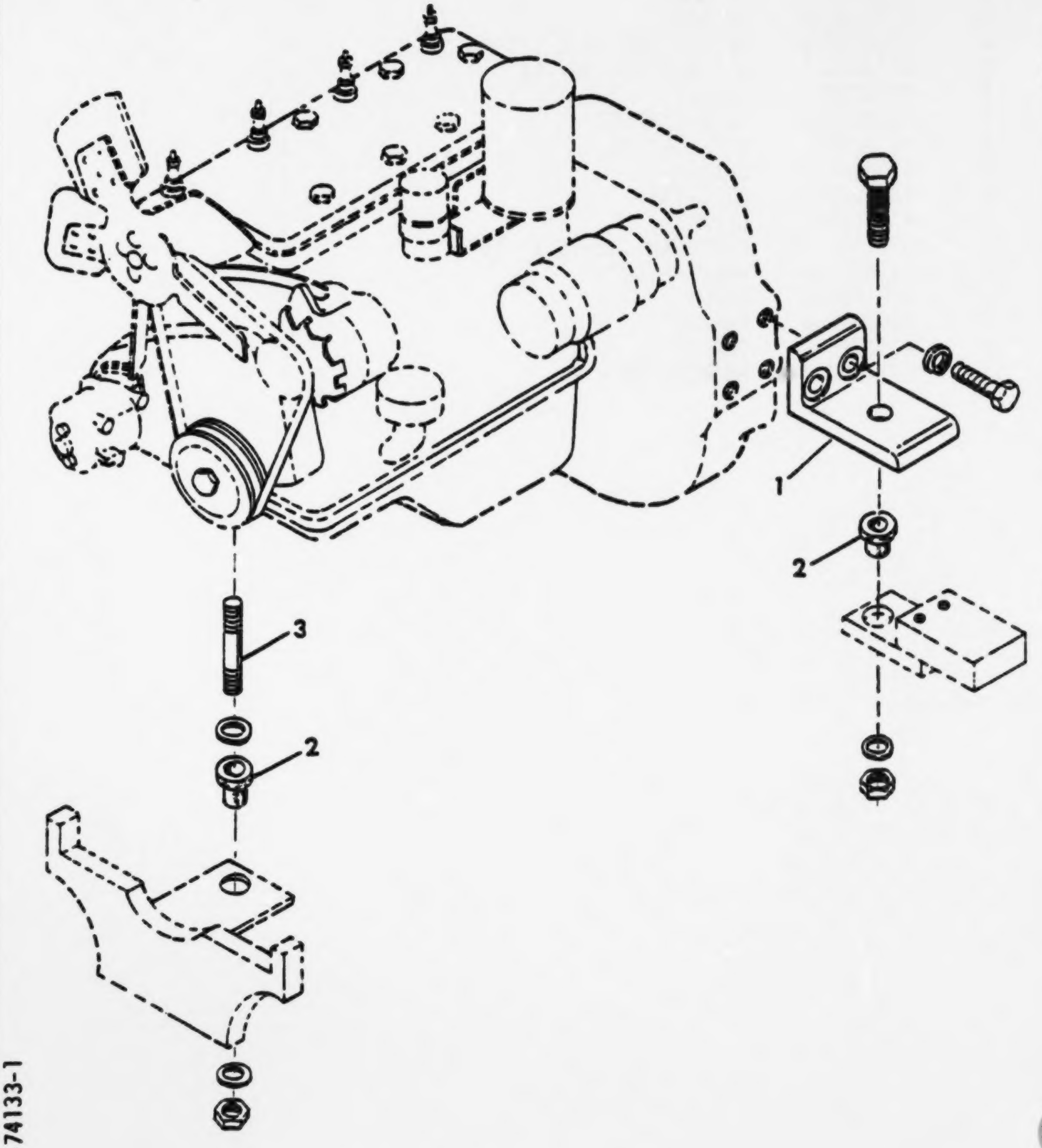
GOVERNOR

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4909854-4	GOVERNOR ASSY	1	
2	4909637-3	ARM-ROCKER	2	
3	4909934-4	PIN-GROOVE	1	
4	4909638-1	BEARING	1	
5	4255400-6	JOINT-BALL-.25"-28	1	
	0920437-1	NUT-.25"-28	1	
6	4862045-4	JOINT-BALL-.25"-28	1	
7	4912141-1	ROD-CONTROL	1	
	0924960-8	NUT-.25"-28	2	
8	4909858-5	SPRING-GOVERNOR	1	ONE GREEN END
9	4909855-1	BRACKET-GOVERNOR SPRING	1	
10	4909820-5	CAPSCREW	2	
	0916965-7	LOCKWASHER-.38"	2	
11	4909636-5	LEVER ASSY-GOVERNOR	1	
12	4912142-9	SCREW-ADJUSTING	1	
	0914192-0	NUT-.25"-28	2	


770810-71146-1

EXHAUST SYSTEM

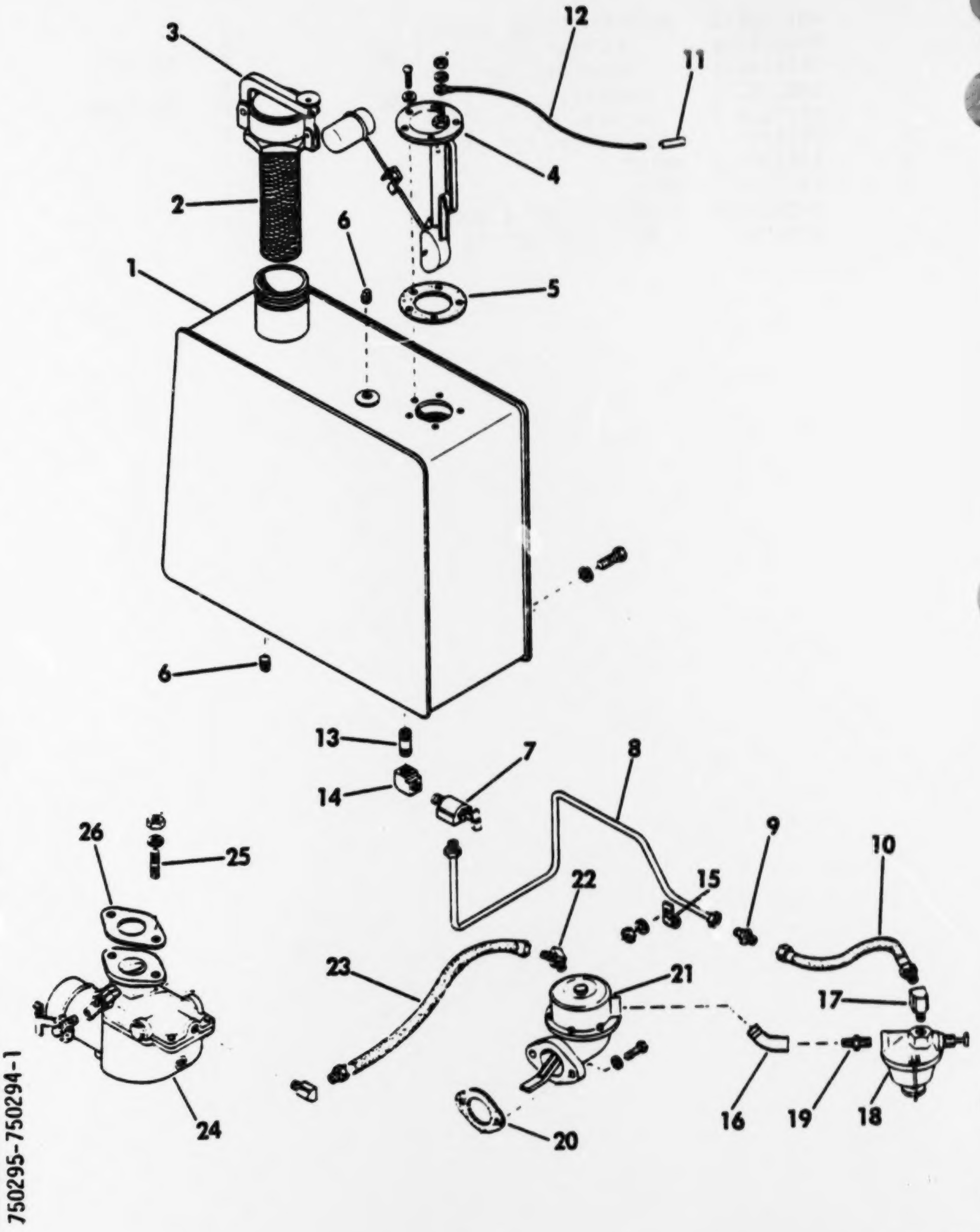
ITEM	PART NO.	DESCRIPTION	QTY.
1	4826128-3	MUFFLER	1
2	4710442-7	GROMMET	2
3	4711590-2	WASHER	2
4	0926053-0	SCREW-.38"-16 X 1.75"	2
5	0916954-1	NUT-PLATED-.38"-16	2
6	4848758-1	GASKET	1
7	4860602-4	PIPE-EXHAUST	1
8	0917258-6	NUT-.38"-16	2
9	4708304-3	CLAMP	1
10	4820972-0	PIPE-TAIL	1
11	4716088-2	CLAMP	1
12	0921965-0	CAPSCREW-.38-16 X .75"	1
13	0916965-7	WASHER-.38"	1
14	4251726-8	CLAMP	1
15	4861993-6	GUARD	1
16	4251726-8	CLAMP	2
17	0917642-1	WASHER-.38"	4



770843-74133-1

ENGINE MOUNTING-POWER SHIFT

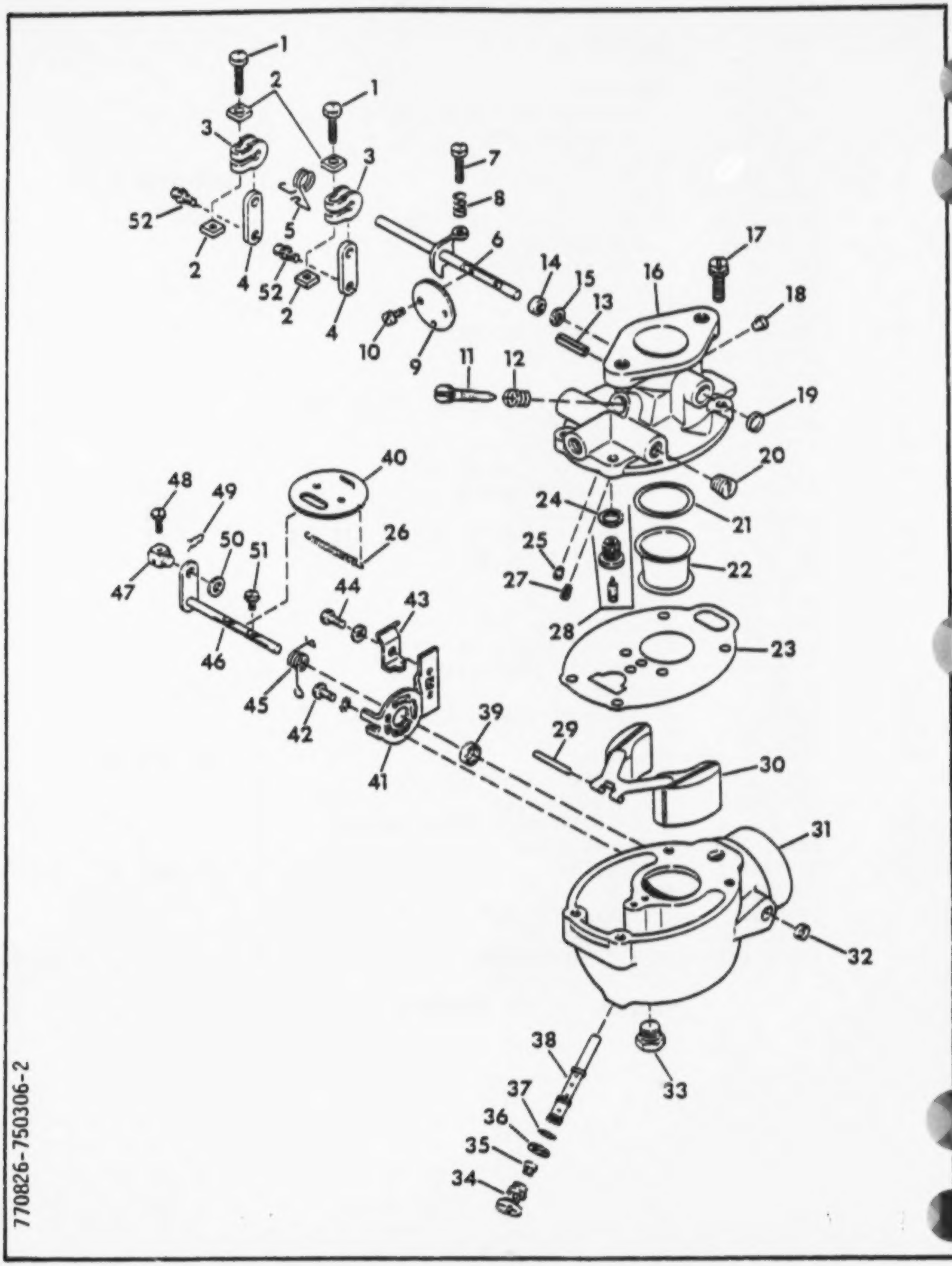
ITEM	PART NO.	DESCRIPTION	QTY.	
1	4857898-3	BRACKET-ENGINE SUPPORT	2	
	0923781-9	CAPSCREW-.50"-13 X 1.50"	4	TO HSG
	0916966-5	LOCKWASHER-.50"	4	
	0920587-3	CAPSCREW-.62"-11 X 3.50"	2	TO FRAME
	0929306-9	WASHER-.69" X 2.50"	2	
	0923351-1	NUT-LOCK-.62"-11	2	
2	4755785-5	MOUNT	3	
3	4857245-7	STUD	1	
	0929306-9	WASHER-.69" X 2.50"	2	
	0923351-1	NUT-LOCK-.62"-11	1	


750295-750294-1

FUEL SYSTEM-GAS

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4831754-9	TANK-FUEL	1	
	0921210-1	CAPSCREW-.38"-16 X 1.00"	4	
	0916965-7	LOCKWASHER-.38"	4	
2	4991217-3	SCREEN ASSY	1	
3	4749382-0	CAP-FILLER	1	INCL ITEM 2
4	4905897-7	SENDER-FUEL	1	
	0917452-5	SCREW-RD HD-#10-32 X .50"	5	
	4255574-8	WASHER-DYNASEAL	5	
	0917365-9	LOCKWASHER-#10	1	
	0917415-2	NUT-#10-32	1	
5	4735714-0	GASKET	1	
6	0901652-8	PLUG-PIPE-SQ HD-.25"TT	1	
7	4716873-7	VALVE-SHUT OFF	1	
8	4856620-2	TUBE ASSY	1	
9	0910995-0	UNION-.31" TUBE X .50"-20 STR THD	1	
10	4826143-2	HOSE ASSY-FUEL	1	
11	4736044-1	CONNECTOR-WIRE	1	
12	4790065-9	WIRE-BLACK-16 GA-10.00"	1	
	4408655-1	TERMINAL-RING-#10	1	
	4724667-0	TERMINAL-TIP	1	
13	0904709-3	NIPPLE-PIPE-.25" X .50"-20 STR THD	1	
14	0901677-5	ELBOW-90° PIPE-.25"	1	
15	4767130-0	CLAMP	1	
	0917372-5	NUT-.31"-18	1	
	0917356-8	LOCKWASHER-.31"	1	
16	0920655-8	ELBOW-45°-BRASS-.12"-27	1	
17	0915399-0	ELBOW-90°-STREET-.12"-27	2	
18	4730551-1	STRAINER-FUEL	1	SEE PAGE 45
19	0920215-1	NIPPLE-PIPE-BRASS-.12"-27	1	
20	4848885-2	*GASKET-PUMP	1	
21	4908789-3	PUMP-FUEL	1	INCL ITEM 20
	0921332-3	CAPSCREW-.31"-18 X .75"	2	
	0917356-8	LOCKWASHER-.31"	2	
22	0910140-3	ELBOW-90°-BRASS-.12" X .50"-20	1	
23	4856781-2	HOSE ASSY-FUEL	1	
24	4881389-3	CARBURETOR	1	SEE PAGE 41
25	4347088-9	STUD	2	
	0916965-7	LOCKWASHER-.38"	2	
	0916602-6	NUT-.38"-24	2	
26	4001645-3	GASKET-CARBURETOR	1	

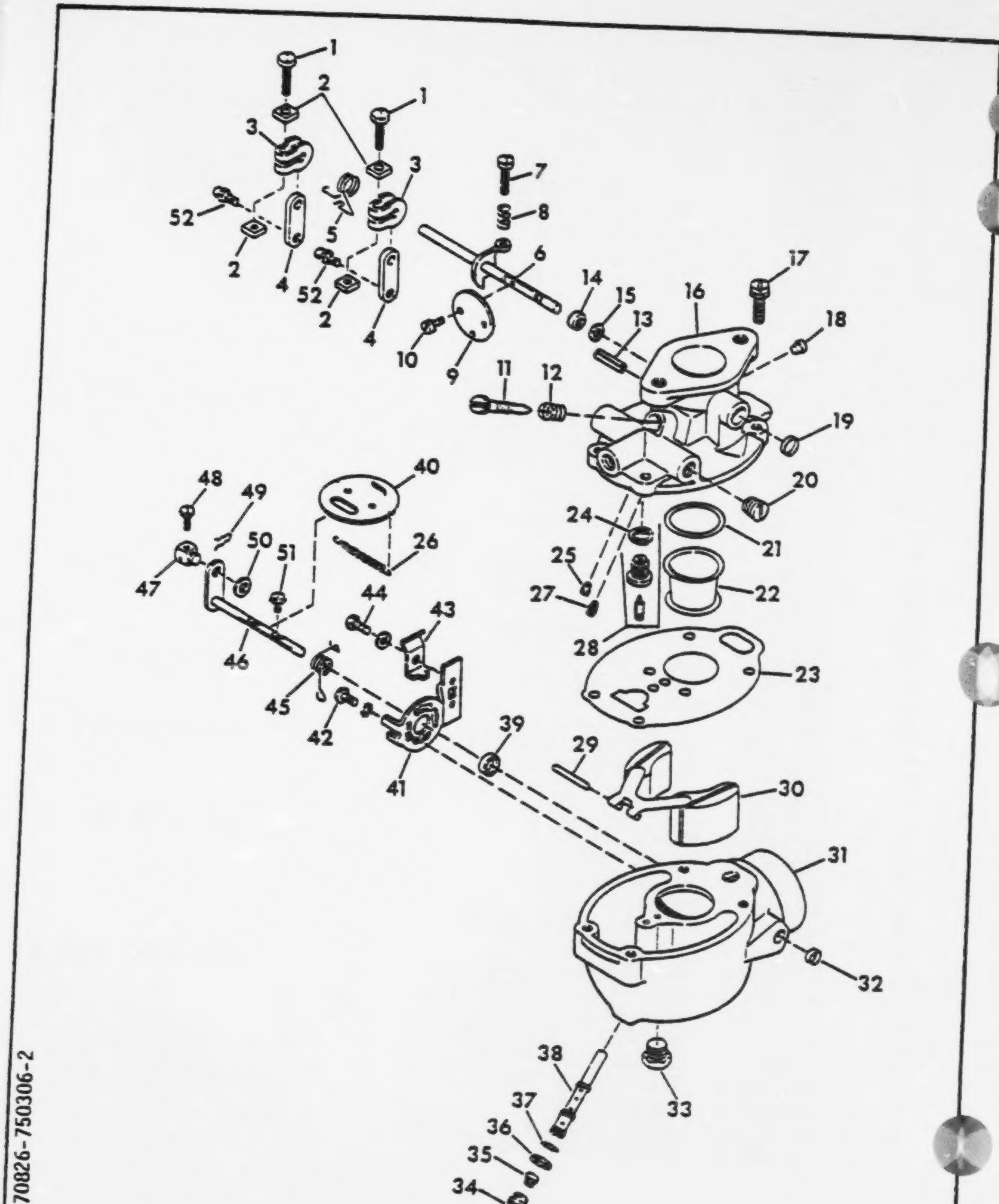
*INCLUDED IN KIT 4909835-3


770826-750306-2

CARBURETOR ASSY-4881389-2

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4055321-6	SCREW-CLEVIS CLAMP	2	
2	0910371-4	NUT-CLEVIS CLAMP	4	
3	4912946-3	CLEVIS ASSY	2	INCL ITEM 1-2
4	4912947-1	LEVER-THROTTLE	2	
5	0239168-8	SPRING-CLEVIS RETURN	1	
6	4909942-7	*SHAFT ASSY-THROTTLE	1	INCL ITEM 7-8
7	0220000-4	SCREW-ADJ-THROTTLE	1	
8	0219977-6	SPRING-ADJ-SCREW	1	
9	0251710-0	FLY-THROTTLE	1	
10	4051689-0	*SCREW-THROTTLE FLY	2	
11	0219987-5	*NEEDLE-IDLE ADJ	1	
12	0219978-4	*SPRING-ADJ-NEEDLE	1	
13	4051736-9	PIN-THROTTLE STOP	1	
14	0226447-1	*RETAINER-SHAFT PACKING	1	
15	0226446-3	*PACKING-THROTTLE SHAFT	1	
16	---------	BODY ASSY-THROTTLE	1	ORDER 4881389-2
17	0226451-3	SCREW-THROTTLE-BODY TO BOWL	4	
18	0800465-7	PLUG-IDLE HOLE DRILLING	1	
19	0257091-9	*RETAINER-CUP	1	
20	4046803-5	PLUG-FUEL INLET	1	
21	0251726-6	RETAINER-VENTURI	1	
22	4909947-6	VENTURI	1	
23	0226452-1	*GASKET-THROTTLE-BODY TO BOWL	1	
24	0219998-2	GASKET-FLOAT VALVE	1	
25	4909949-1	*JET-IDLE	1	
26	4052258-3	SPRING-CHOKE VALVE	1	
27	4912628-7	*JET-ECONOMIZER	1	
28	4909954-2	*VALVE & SEAT ASSY-FLOAT	1	INCL ITEM 24
29	0226457-0	*SHAFT-FLOAT	1	
30	0226456-2	FLOAT & LEVER ASSY	1	
31	---------	BODY ASSY-CARBURETOR	1	ORDER 4881389-2
32	4046835-7	PLUG-CHOKE SHAFT	1	
33	4046803-5	PLUG-FUEL DRAIN	1	
34	1123070-3	PLUG-NOZZLE	1	
35	4909951-8	*POWER JET ASSY	1	INCL ITEMS 34
36	0226468-7	*GASKET-NOZZLE	1	
37	0257092-7	O-RING-NOZZLE	1	
38	4909948-4	*NOZZLE	1	
39	4046832-4	*PACKING-CHOKE SHAFT	1	
40	1119448-7	FLY ASSY-CHOKE	1	
41	0237168-0	BRACKET ASSY-CHOKE	1	INCL ITEMS 42-43-44
42	4046824-1	SCREW-CHOKE BRACKET	1	
43	4047137-7	CLIP-CHOKE BRACKET	1	
44	4055050-1	SCREW-CLIP RETAINING	1	
45	4046828-2	SPRING-CHOKE RETURN	1	
46	4912742-6	SHAFT ASSY-CHOKE	1	
47	4045429-0	SWIVEL-CHOKE	1	
48	0222045-7	SCREW-SWIVEL	1	
49	0222069-7	COTTER-SWIVEL RETAINING	1	

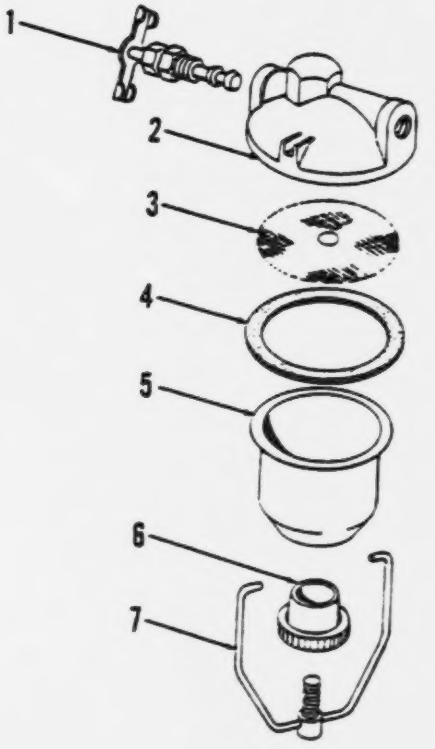
CONTINUED


770826-750306-2

CARBURETOR ASSY-4881389-2 (CONTINUED)

ITEM	PART NO.	DESCRIPTION	QTY.
50	4055324-0	WASHER	1
51	4051689-0	*SCREW-CHOKE FLY	2
52	4912948-9	BALL-10-32 THD-.26"	2

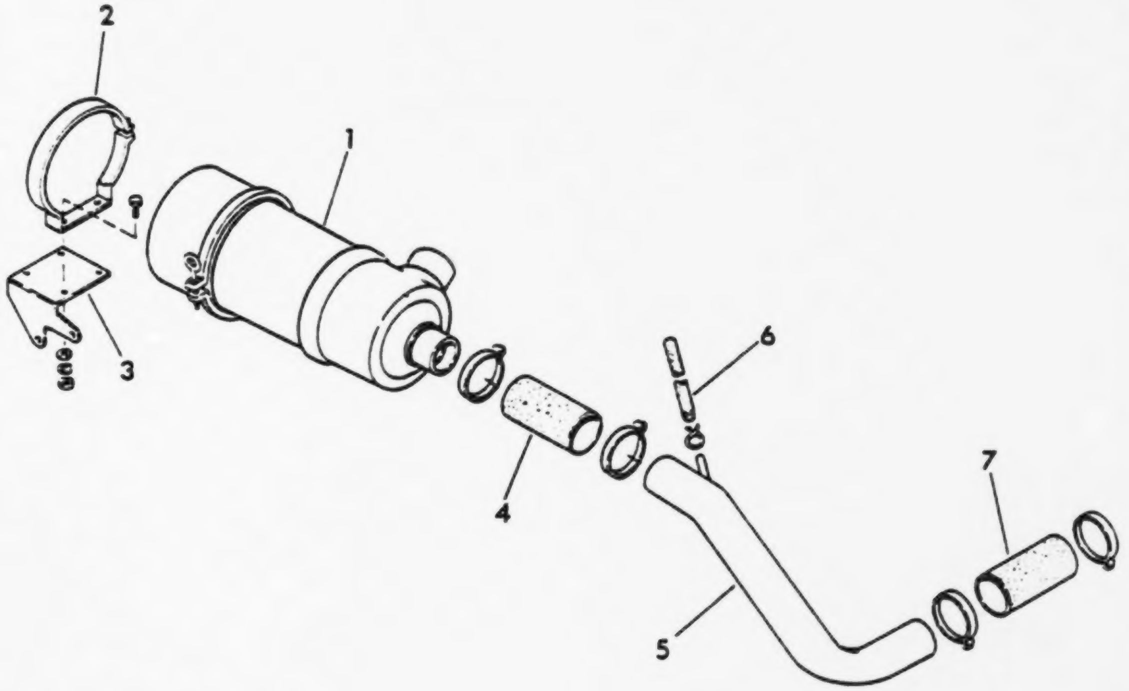
*INCL IN KIT 4912743-4



18367

FUEL STRAINER-4730551-1

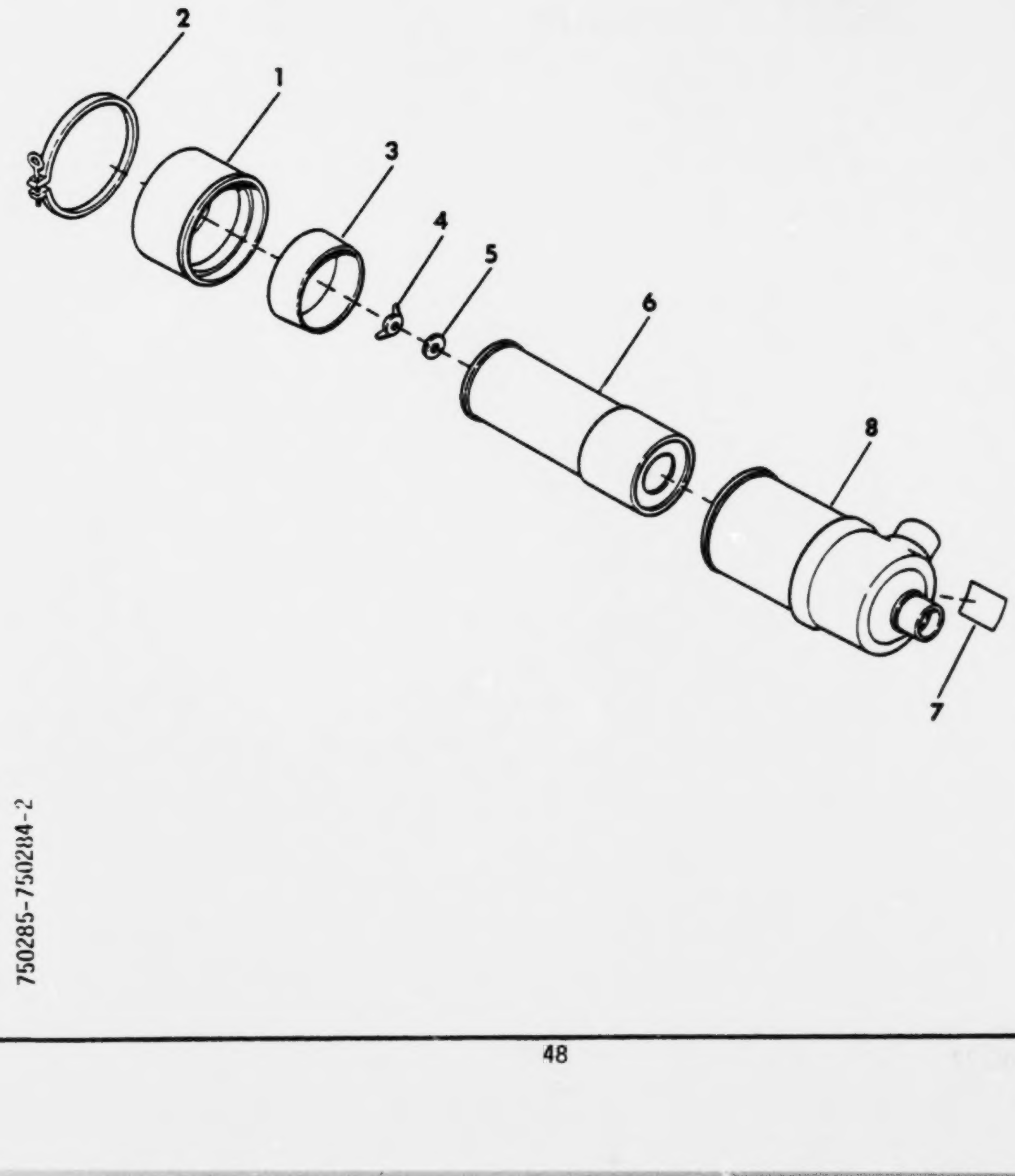
ITEM	PART NO.	DESCRIPTION	QTY.	
1	4981110-2	SHUT-OFF	1	
2	4981104-5	COVER	1	
3	4981105-2	SCREEN	1	
4	4981106-0	GASKET	1	
5	4981107-8	BOWL-METAL	1	
6	4981108-6	NUT-CUP	1	
7	4981109-4	WIRE ASSEMBLY-CLAMP	1	INCL STUD



770809-750280-2

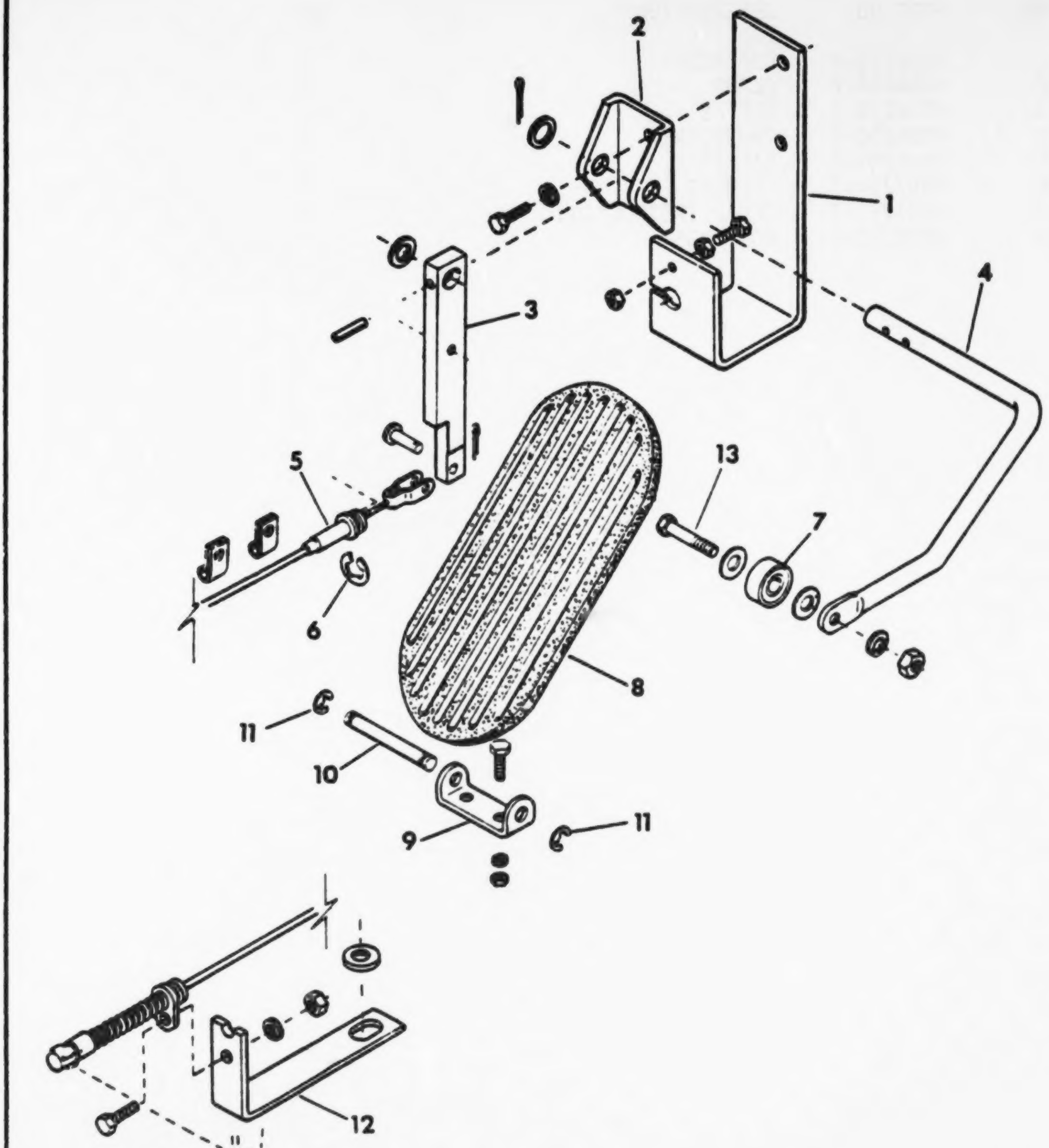
AIR CLEANER

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4841879-2	CLEANER ASSY-AIR	1	SEE PAGE 49
2	4789058-7	CLAMP-MOUNTING	2	
	0921332-3	CAPSCREW-.31"-18 X .75"	4	
	0917356-8	LOCKWASHER-.31"	4	
	0918265-0	WASHER-.34" X .69"	4	
	0917372-5	NUT-.31"-18	4	
3	4858427-0	SUPPORT	1	
4	4612316-2	HOSE	1	
	0922198-5	CLAMP-HOSE-# 32	2	
5	4858279-5	TUBE ASSY	1	
6	4810047-9	HOSE	1	
	0921910-6	CLAMP-HOSE-#6	2	
7	4810695-9	HOSE	1	
	0922198-5	CLAMP-HOSE-#32	2	


750285-750284-2

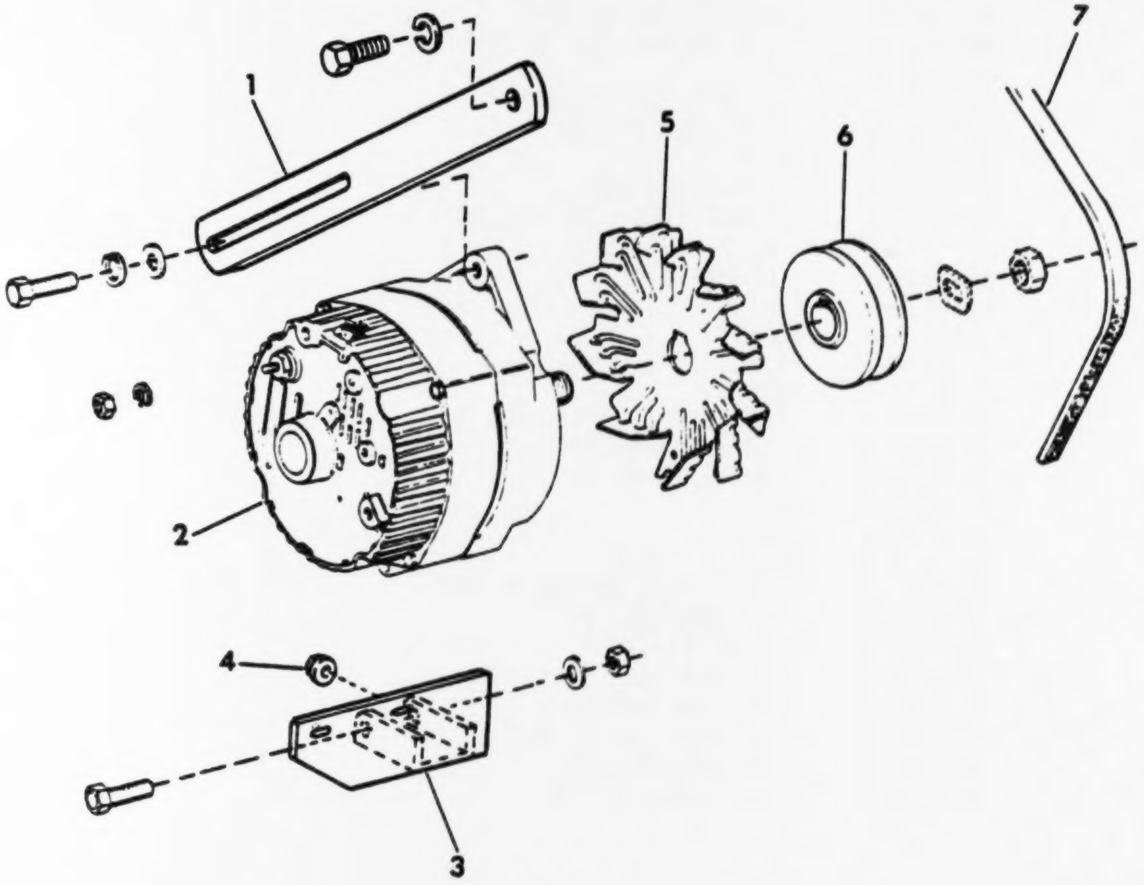
AIR CLEANER-4841879-2

ITEM	PART NO.	DESCRIPTION	QTY.
1	4996255-8	CUP ASSY	1
2	4996464-6	CLAMP	1
3	4996254-1	BAFFLE	1
4	4996250-9	THUMBSCREW	1
5	3046862-3	GASKET	1
6	4907794-3	ELEMENT	1
7	4996251-7	DECAL-INSTRUCTION	1
8	4996252-5	BODY ASSY	1


780109-751445-1

ACCELERATOR

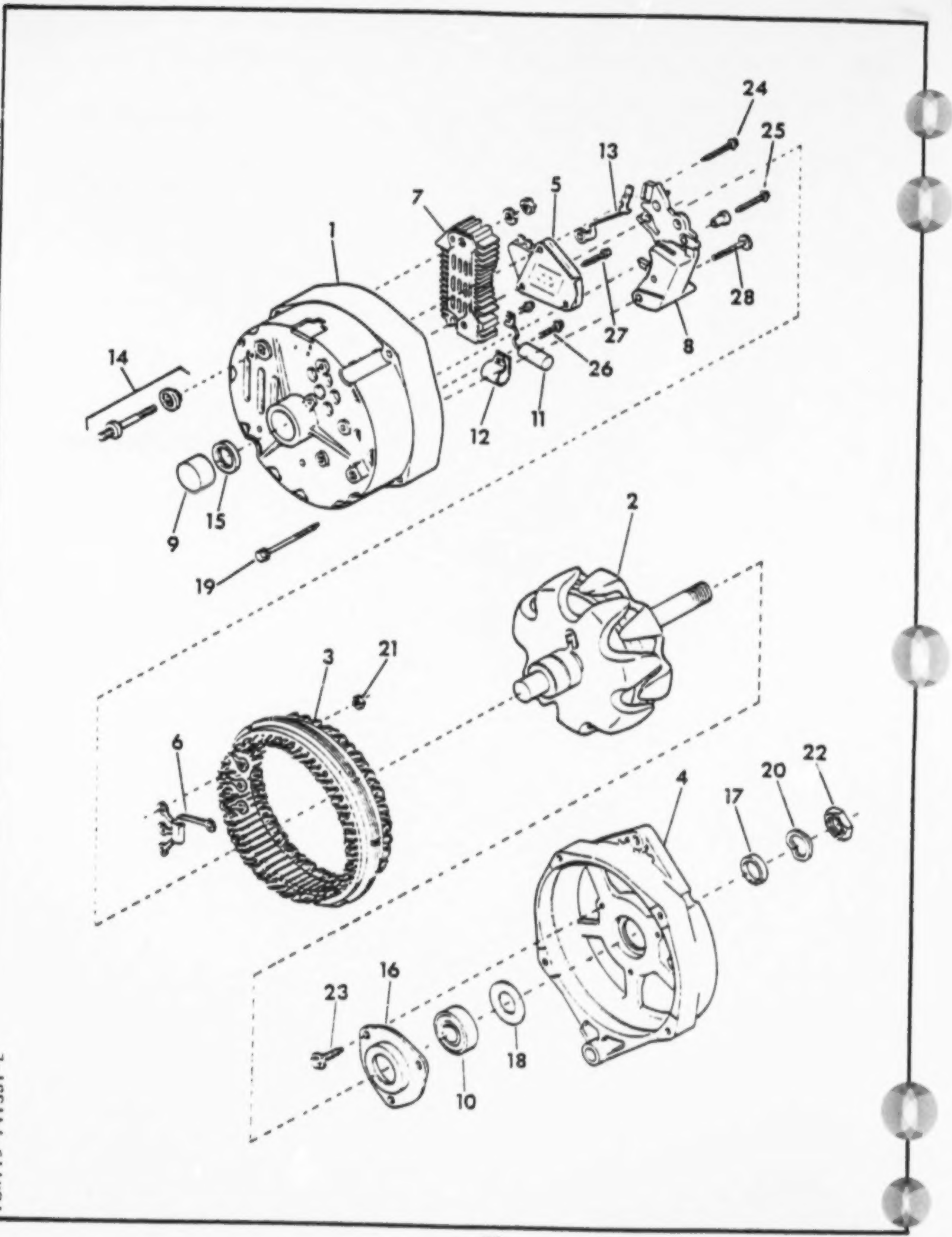
ITEM	PART NO.	DESCRIPTION	QTY.	
1	4864082-5	BRACKET	1	
	0921055-0	CAPSCREW-.25"-20 X 2.00"	1	
	0916622-4	NUT-.25"-20	2	
2	4864085-8	SUPPORT	1	
	0921966-8	CAPSCREW-.38"-16 X .88"	2	
	0916965-7	LOCKWASHER-.38"	2	
3	4818813-0	LEVER	1	
	0919327-7	WASHER-.53" X .94"	1	
	0916169-6	PIN-SPRING-.19" X .75"	1	
4	4868125-8	SHAFT	1	
	0919327-7	WASHER-.53" X .94"	1	
	0929585-8	PIN-.06" X 1.00"	1	
5	4868749-5	CABLE	1	
	0929591-6	PIN-YOKE-.19"	1	
	0918625-5	PIN-COTTER-.05" X 1.00"	1	
	0929597-3	CLIP-.25" ID	1	TILT CYL BRKT
	0928135-3	CLAMP-.31" ID	1	
6	4255401-4	E-RING	1	
7	4761270-0	BEARING	1	
8	4765514-1	PEDAL	1	
9	4735718-1	BRACKET	1	
	0923341-2	CAPSCREW-.25"-20 X .75"	2	
	0916964-0	LOCKWASHER-.25"	2	
	0916622-4	NUT-.25"-20	2	
10	4774640-9	PIN	1	
11	4255183-8	E-RING	2	
12	4888301-1	BRACKET-CABLE	1	
	0923341-2	CAPSCREW-.25"-20 X .75"	1	
	0916964-0	LOCKWASHER-.25"	1	
	0916622-4	NUT-.25"-20	1	
	0918432-6	WASHER-.62" X .81"	1	
13	0921967-6	CAPSCREW-.38"-16 X 1.12"	1	
	0911987-6	WASHER-.38" X .56"	2	
	0916965-7	LOCKWASHER-.38"	1	
	0916950-9	NUT-JAM-.38"-16	1	



750273-750272-1

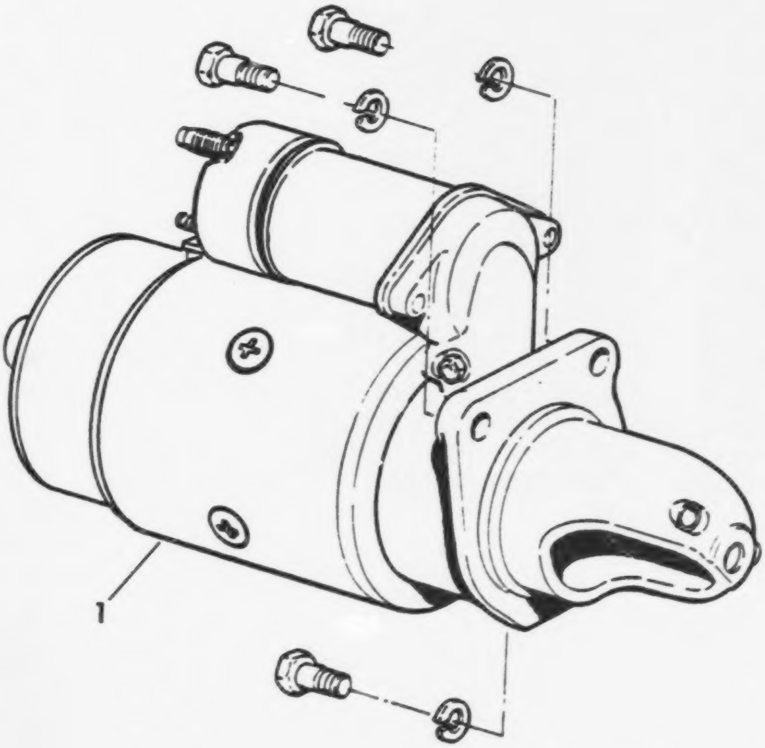
ALTERNATOR

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4856618-6	BRACE-ADJUSTING	1	
	0921333-1	CAPSCREW-.31"-18 X 1.00"	1	TO ALTERNATOR
	0918265-0	WASHER-.34" X .69"	1	
	0917356-8	LOCKWASHER-.31"	1	
	0921966-8	CAPSCREW-.38"-16 X .88"	1	TO WATER PUMP
	0916965-7	LOCKWASHER-.38"	1	
2	4883374-3	ALTERNATOR ASSY	1	SEE PAGE 55
	0917389-9	LOCKWASHER-#12	1	
	0917376-6	NUT-#12-24	1	
3	4866350-4	BRACKET-ALTERNATOR	1	P/S
	0922918-8	CAPSCREW-.38"-16 X 3.25"	1	
	0916965-7	LOCKWASHER-.38"	1	
	0916950-9	NUT-.38"-16	1	
4	4255041-8	NUT-FLANGED	2	
5	3057632-6	FAN	1	
6	4848486-9	PULLEY	1	
7	---------	BELT	-	SEE WATER PUMP


780119-741351-2

ALTERNATOR ASSY-4883374-3

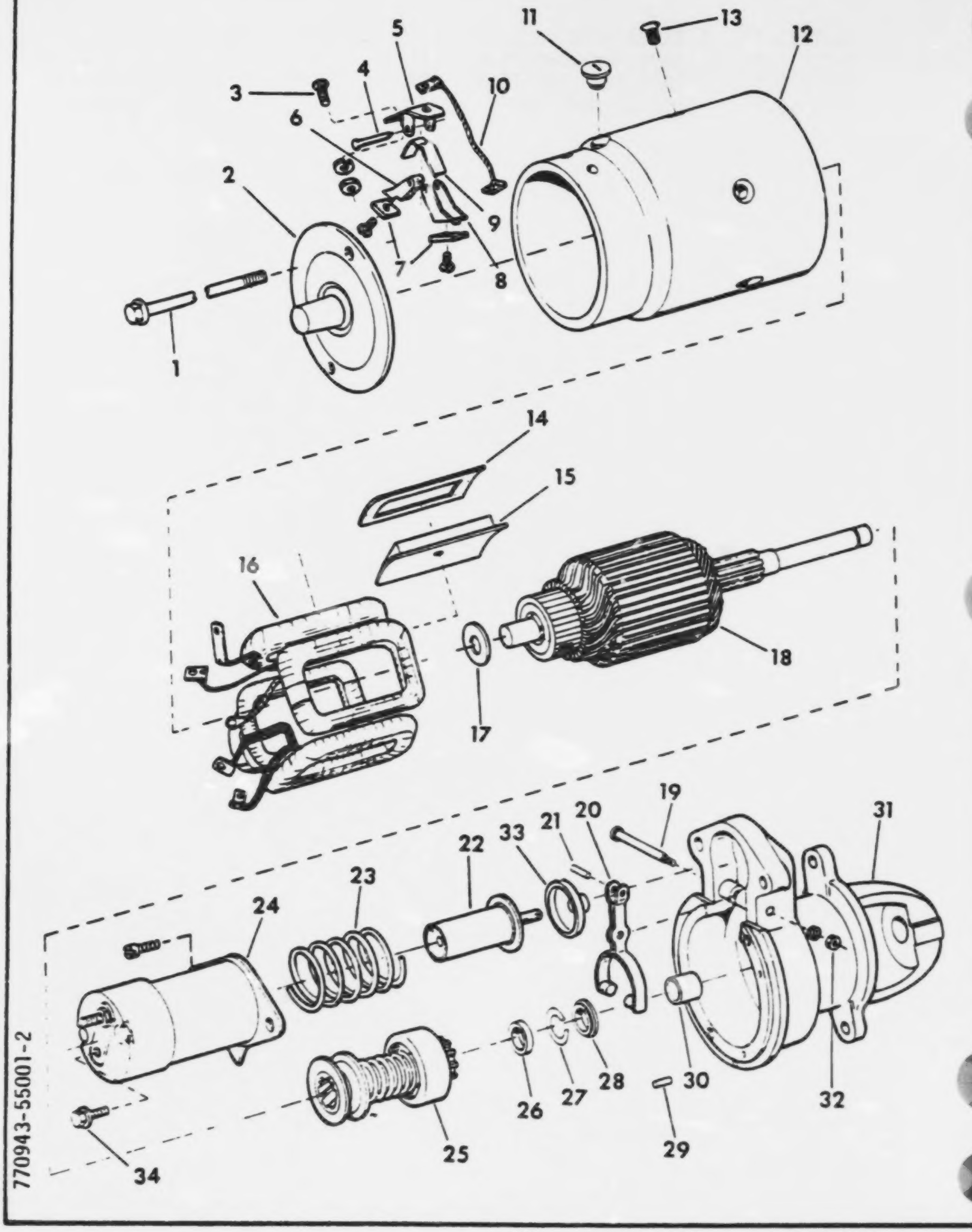
ITEM	PART NO.	DESCRIPTION	QTY.	
1	4913144-4	FRAME	1	INCL ITEMS 9 & 15
2	1174683-1	ROTOR ASSY	1	
3	4913145-1	STATOR ASSY	1	
4	1142678-0	FRAME-DRIVE END	1	
5	1172893-8	REGULATOR	1	
6	1172891-2	DIODE TRIO	1	
7	4912740-0	BRIDGE-RECTIFIER	1	
8	0262167-0	BRUSH HOLDER & ASSY	1	
9	1142670-7	BEARING-ROLLER	1	
10	1148619-8	BEARING-BALL-DRIVE END	1	
11	1172896-3	CAPACITOR	1	
12	4054348-0	BRACKET-CAPACITOR	1	
13	0262170-4	TERMINAL PKG-RELAY	1	
14	1172897-4	TERMINAL PKG-BATTERY	1	
15	1142677-2	SEAL-OIL	1	
16	0242826-6	PLATE-RETAINER	1	
17	0242829-0	COLLAR-SHAFT-OUTER	1	
18	1172899-5	WASHER-GREASE	1	
19	0242838-1	BOLT-THRU	4	
20	0237006-2	LOCKWASHER-SHAFT	1	
21	0917385-7	NUT-RECTIFIER BRIDGE	3	
22	4054799-2	NUT-SHAFT-DRIVE END	1	
23	0243792-6	SCREW-RETAINER PLATE	3	
24	0262168-8	SCREW-BRUSH HOLDER	1	GRD
25	4908768-7	SCREW-BRUSH HOLDER	2	INS
26	1173329-2	SCREW-CAPACITOR BRACKET	2	
27	1013727-1	SCREW-RECTIFIER BRIDGE	1	
28	0262169-6	SCREW-BRUSH HOLDER	1	



73484

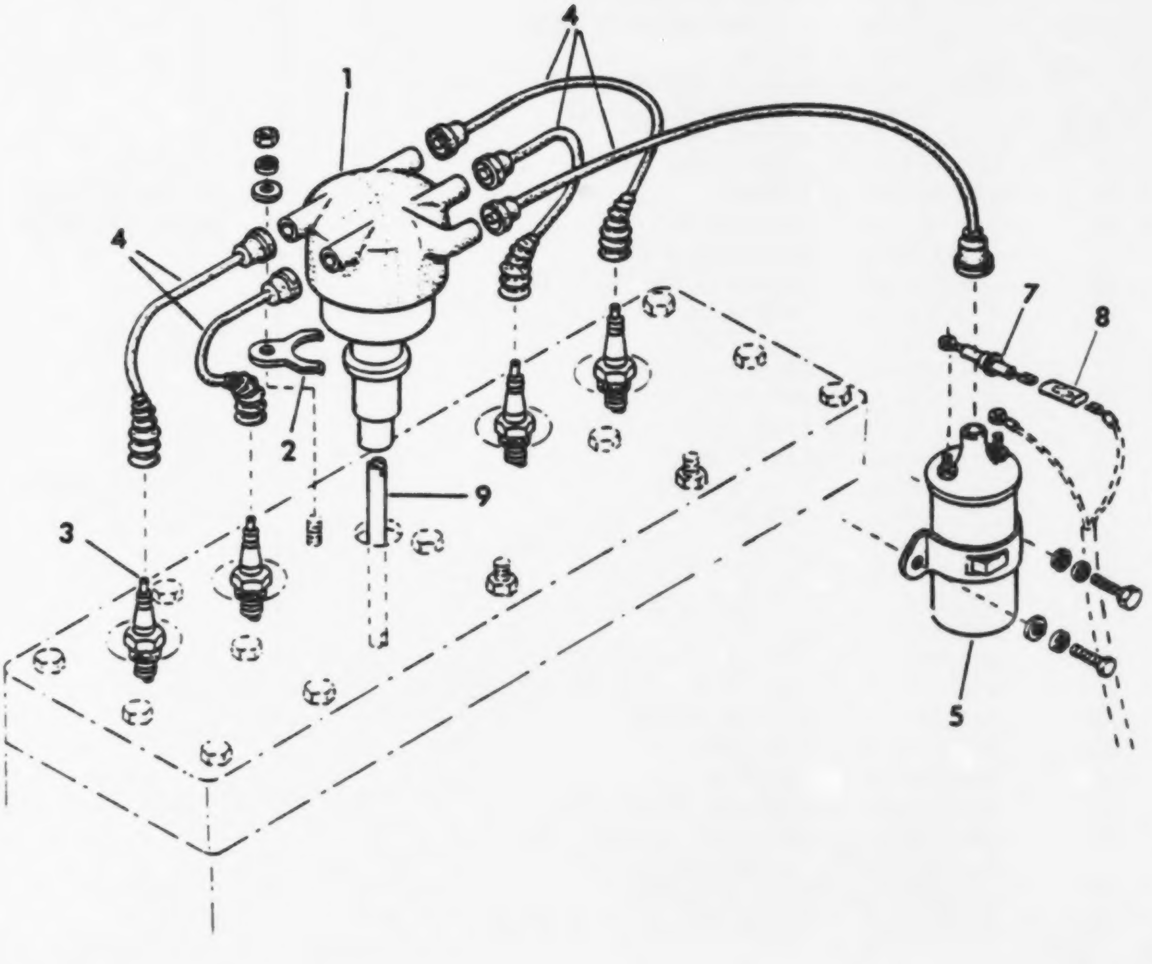
STARTER

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4885883-1	STARTER ASSY	1	SEE PAGE 59
	0920415-7	CAPSCREW-.38"-16 X 1.25"	2	
	0921210-1	CAPSCREW-.38"-16 X 1.00"	1	
	0916965-7	LOCKWASHER-.38"	3	


770943-55001-2

STARTER ASSY-4885883-1

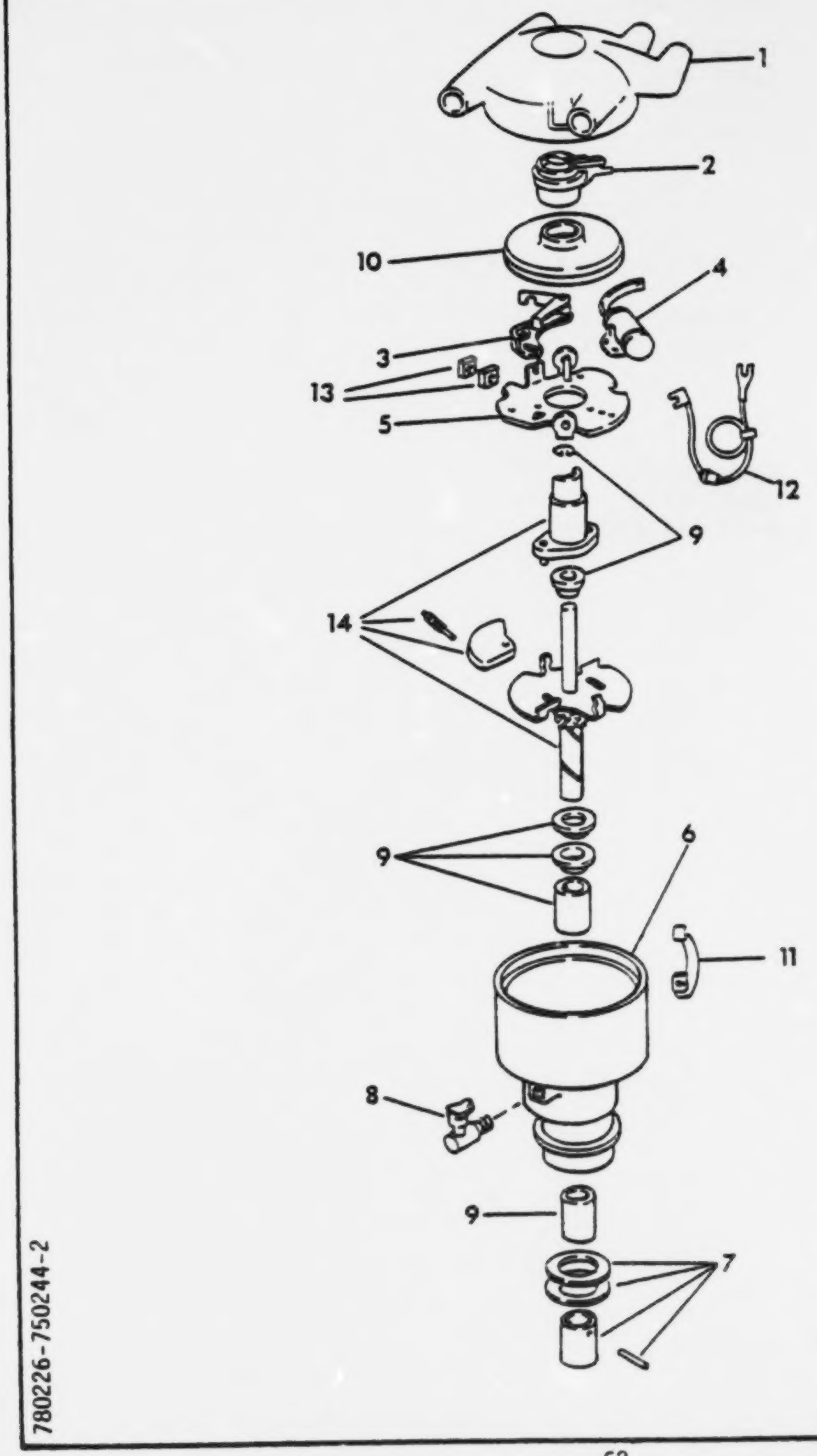
ITEM	PART NO.	DESCRIPTION	QTY.	
1	0231321-1	BOLT-THRU	2	
2	4913371-3	FRAME-COMMUTATOR END	1	
3	0916080-5	SCREW-SUPPORT-#10-24 X .50"	4	
	0917365-9	LOCKWASHER-#10	4	
	0916621-6	NUT-#10-24 X .50"	4	
4	0252042-7	PIN-SUPPORT ATTACHING	2	
5	4051281-6	SUPPORT-BRUSH HOLDER PKG	1	INCL 3-4-10
6	4051279-0	HOLDER-BRUSH-INS	2	
	0927150-3	SCREW-#8-24 X .62"	2	
7	4051276-6	BRUSH	4	
8	4055871-0	HOLDER-BRUSH-GRD	2	
	0927149-5	SCREW-#8-32-.62"	2	
9	4051277-4	SPRING-BRUSH	4	
10	4060192-4	LEAD-BRUSH GRD	2	
11	4913376-2	GROMMET	1	IN FIELD FRAME
12	---------	FRAME-FIELD	1	ORDER 4885883-1
13	4054758-0	SCREW-POLE SHOE	4	
14	4051272-5	INSULATION-FIELD COIL	4	
15	4051269-1	SHOE-POLE	4	
16	4913372-1	COIL-FIELD	1	FOUR COILS
17	4042697-5	WASHER-BRAKE	1	
18	4908995-5	ARMATURE	1	
19	4997175-7	STUD-SHIFT LEVER	1	
20	4998851-2	LEVER-SHIFT	1	
21	4913304-4	PIN-PLUNGER	1	TO SHIFT LEVER
22	0246077-2	PLUNGER	1	
23	4997176-5	SPRING-PLUNGER RETURN	1	
24	4912314-4	SWITCH-SOLENOID	1	
	0901228-7	SCREW-.25"-20 X .75"	2	
25	4906418-1	DRIVE ASSY	1	
26	4997180-7	COLLAR-PINION STOP	1	
27	4997181-5	RING-PINION STOP RETAINER	1	
28	0243855-4	WASHER-THRUST	1	
29	4042650-4	PIN-DOWEL	1	
30	4044397-0	BUSHING	1	
31	4908997-2	HOUSING-DRIVE END	1	
32	0246098-8	NUT-SHIFT LEVER STUD	1	
	0917356-8	LOCKWASHER-.31"	1	
33	4913373-9	BOOT-PLUNGER	1	
34	4997184-9	SCREW-FIELD LEAD TO SW	1	



780111-770811-1

DISTRIBUTOR

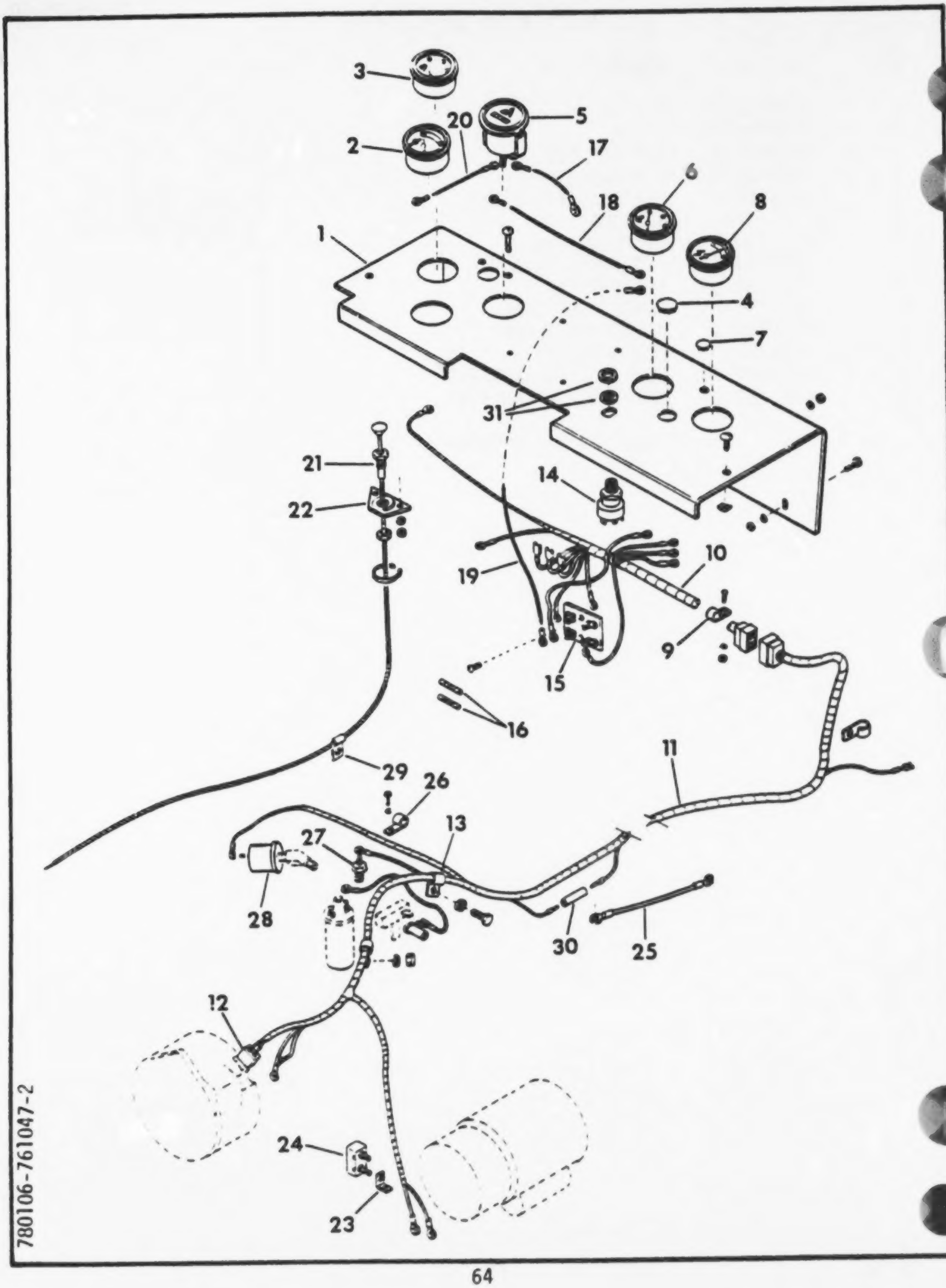
ITEM	PART NO.	DESCRIPTION	QTY.	
1	4857878-5	DISTRIBUTOR ASSY	1	SEE PAGE 63
2	4858103-7	CLAMP-ARM	1	
	0918266-7	WASHER-.41" X .81"	1	
	0916965-7	LOCKWASHER-.38"	1	
	0916950-9	NUT-.38"-16	1	
3	4910105-8	PLUG-SPARK	4	
4	4912176-7	WIRE KIT-IGNITION	1	
5	4889580-9	COIL-IGNITION	1	
	0925205-7	CAPSCREW-.31"-18 X 1.00"	2	
	0917356-8	LOCKWASHER-.31"	2	
	0919326-9	WASHER-.34" X .75"	2	
6				
7	4832743-1	DIODE ASSY	1	
8	4255521-9	CONNECTOR	1	
9	4909828-8	SHAFT-DISTRIBUTOR	1	


780226-750244-2

DISTRIBUTOR ASSY-4857878-5

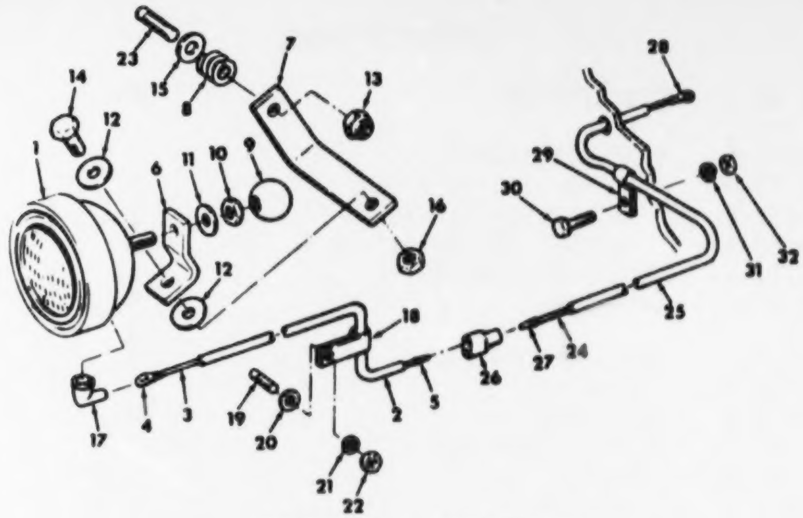
ITEM	PART NO.	DESCRIPTION	QTY.	
1	4909102-8	CAP	1	
2	4909103-6	*ROTOR	1	
3	4909100-2	*CONTACT SET	1	
4	4909101-0	*CONDENSER	1	
5	4909104-4	PLATE ASSY-BREAKER	1	INCL ITEMS 3 & 4
6	---------	HOUSING	1	ORDER DIST ASSY
7	4909110-1	COUPLING PKG	1	
8	4909113-5	FITTING-LUBE-90°	1	
9	4914181-5	BEARING PKG	1	
10	4909112-7	PLATE ASSY-SEAL	1	
11	4909114-3	HINGE PKG-CLAMP	1	
12	4909105-1	LEAD-PRIMARY	1	
13	4913284-8	CLIP & INSULATOR PKG	1	
14	4913252-5	SHAFT-GOV & CAM ASSY	1	

* INCL IN KIT 4910178-5


780106-761047-2

INSTRUMENT PANEL

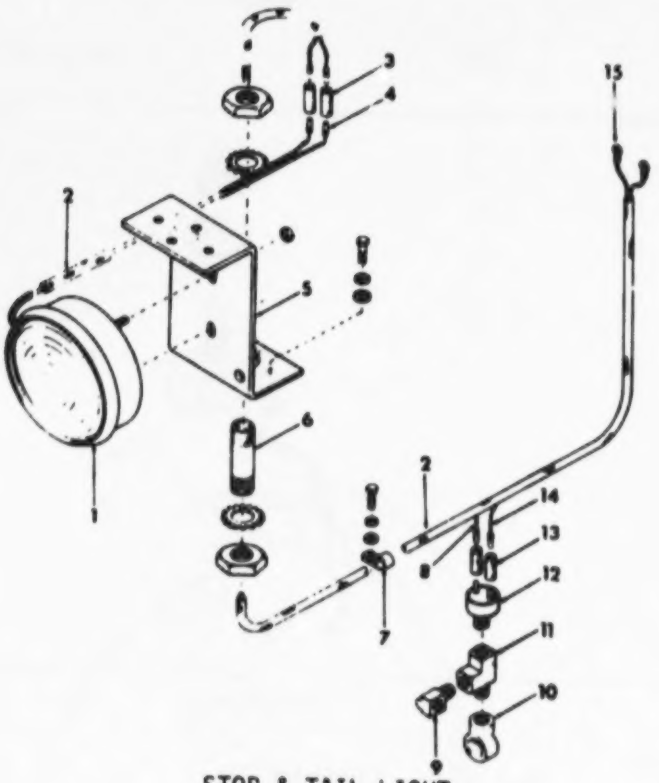
ITEM	PART NO.	DESCRIPTION	QTY.	
1	4886753-5	PANEL-INSTRUMENT	1	
	0918713-9	SCREW-.31"-18 X .50"	2	
	0921355-4	NUT-SPEED-.31"-18	2	
	0923180-4	SCREW-TAPPING-.31"-18 X .75"	4	
2	4818262-0	GAUGE-TEMPERATURE	1	
3	4818261-2	GAUGE-FUEL	1	
			1	
4	0929124-6	PLUG-BUTTON-.81"	1	
5	4867466-7	HOURMETER	1	
6	4818260-4	GAUGE-OIL	1	
7	0921250-7	PLUG-BUTTON-.40"	1	
8	4818263-8	AMMETER	1	
9	4810232-1	CLAMP	1	
	0916081-3	SCREW-.25"-20 X .50"	1	
	0916964-0	LOCKWASHER-.25"	1	
	0916622-4	NUT-.25"-20	1	
10	4856639-2	HARNESS-PANEL	1	
11	4881113-7	HARNESS-FRAME	1	INCL CONN & ITEM 12&30
	0931576-3	CONNECTOR	1	
12	4024701-7	CONNECTOR-ALTNR	1	
13	4767130-0	CLAMP	3	
	0915898-1	LOCKWASHER-IT-ET-.38"	4	
14	4873631-8	SWITCH-IGNITION	1	
15	4708362-1	HOLDER-FUSE	1	
16	4705279-0	FUSE-10 AMP	2	
17	---------	WIRE-BLACK-16 GA-8.00"	1	HRMTR GRD
	4408655-1	TERMINAL-RING-#10	2	
18	---------	WIRE-BLACK-16 GA-12.00"	1	OIL GAUGE
	4408655-1	TERMINAL-RING-#10	2	
19	---------	WIRE-BLACK-16 GA-5.00"	1	
	4408655-1	TERMINAL-RING-#10	2	
20	---------	WIRE-BLACK-16 GA-8.00"	2	
	4408655-1	TERMINAL-RING-#10	4	
21	4863474-5	CONTROL-CHOKE	1	
22	4766588-0	ADAPTER-CHOKE CONTROL	1	
	0920572-5	SCREW-#10-24 X .50"	2	
	0917365-9	LOCKWASHER-#10	2	
	0916621-6	NUT-#10-24	2	
23	4881588-0	LINK-CIRCUIT BREAKER	1	
24	4881489-8	BREAKER-CIRCUIT	1	
25	4704830-1	CABLE ASSY	1	HORN BUTTON
26	4772127-9	CLAMP-HARNESS	2	
	0921332-3	CAPSCREW-.31"-18 X .75"	1	
	0917356-8	LOCKWASHER-.31"	1	
27	---------	SENDER-TEMP	1	SEE CYL HEAD
28	---------	SENDER-OIL PRESSURE	1	SEE CYL BLOCK
29	0917658-7	CLIP	1	
30	4255521-9	CONNECTOR-LINE	1	
31	4873632-6	NUT-1.00"-32	1	
	0919393-9	WASHER-1.02" X 1.63"	1	



HEADLIGHT & CONNECTIONS

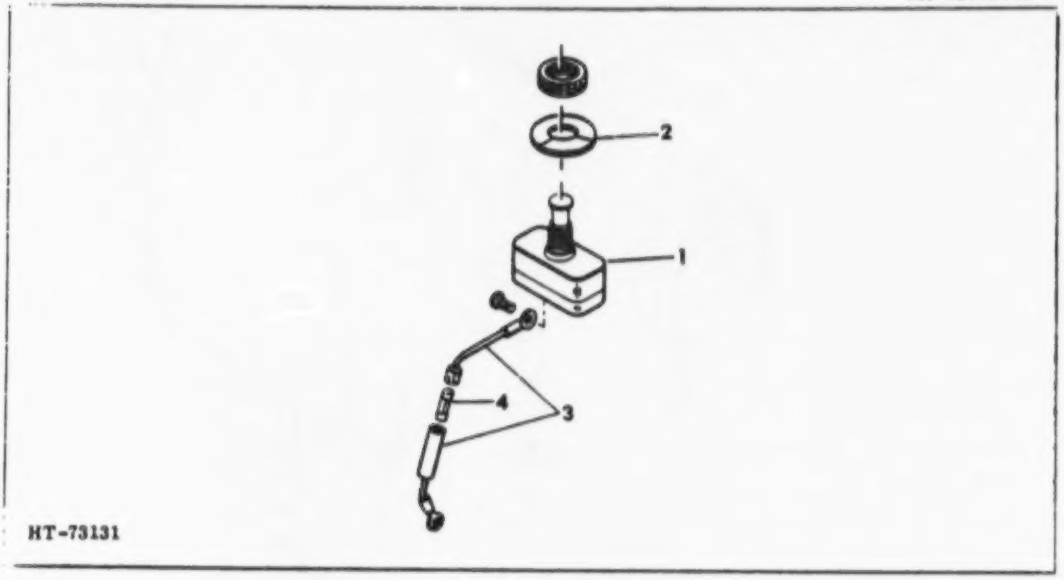
NOTE: FOR DUAL HEADLIGHTS, DOUBLE QUANTITIES

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4775866/9	HEADLAMP ASSY	1	INCL LAMP
2	4715037-0	LOOM - FLEXIBLE	1	
3	4715032/1	WIRE-16 GA. -96"	1	BLACK
4	4254846/1	TERMINAL	1	
5	4724667/3	TERMINAL - TIP	1	
6	4775868/5	BRACKET	1	
7	4775869/3	BRACKET	1	
8	4781446/2	SPRING	1	
9	4775867/7	KNOB	1	
10	0913744/9	NUT-JAM - .5"-13	1	
11	0918431/8	WASHER-.5"	1	
12	0901043/0	WASHER-BRASS-.53"	2	
13	4254976/6	NUT-LOCK	1	
14	0923092-1	CAPSCREW-.5"-13 X 1.12"	1	
15	0927326/9	WASHER-.78"	1	
16	4254976/6	NUT-LOCK	1	
17	4757678/0	BOOT-RUBBER	1	
18	4254481/7	CLAMP	4	ON MAST
19	4255195/2	STUD	4	WELDED TO MAST
20	0923912-3	WASHER	8	
21	0917356/8	LOCKWASHER-.31"	4	
22	0920161/7	NUT-JAM-.31"-18	4	
23	4255431/1	STUD	1	WELDED TO MAST
24	4704825-5	WIRE-16 GA	1	BLACK
25	4737639-7	LOOM-FLEXIBLE	1	
26	4724666/5	CONNECTOR-WIRE	1	
27	4724667/3	TERMINAL-TIP	1	
28	4254846/1	TERMINAL	1	
29	4251645/0	CLIP	1	
30	0921210-1	CAPSCREW-.38"-16 X 1"	1	
31	0916965/7	LOCKWASHER-.38"	1	
32	0916950/9	NUT-.38"-16	1	
	4255355-2	TIE-CABLE	2	



STOP & TAIL LIGHT

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4770449-9	LAMP-STOP & TAIL	1	INCL LAMP
	0928348-2	LAMP (12V)	1	
2	4715037-0	LOOM	2	
3	4736044-1	CONNECTOR-2WIRE	2	
4	4724667-3	TERMINAL TIP	4	
5	4816384-4	BRACKET	1	
	0903625-2	CAPSCREW-1/4"NC X 3/4"	2	
	0920380-3	WASHER-PLATED-1/4" X 7/8"	2	
	0904204-5	LOCKWASHER-1/4"	2	
6	0901502-5	NIPPLE-PIPE	1	
	0913107-9	LOCKWASHER-EXTERNAL 7/8"	2	
	0920321-7	NUT-LOCK 1/2"	2	
7	4251645-0	CLAMP	7	
	0903626-0	CAPSCREW-.31-18 X .75	1	
	0904205-2	LOCKWASHER	1	
	0911421-6	WASHER	1	
8	4715026-3	WIRE-144"-14 GAUGE	1	
9		NOT USED		
10	4735947-6	FITTING	1	
11		NOT USED		
12	4726629-1	SWITCH-STOP LIGHT	1	
13	4702247-0	CONNECTOR	2	
14	4798027-1	WIRE-29"-16 GAUGE	1	
15	4715028-9	WIRE-180"-14 GAUGE	1	

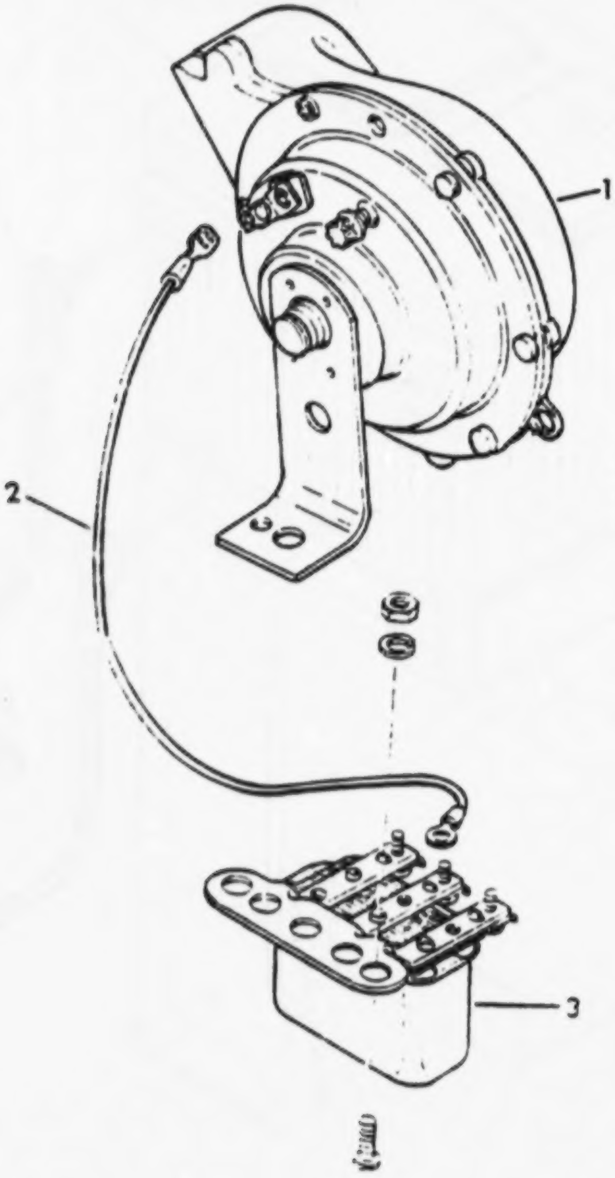


LIGHT SWITCH

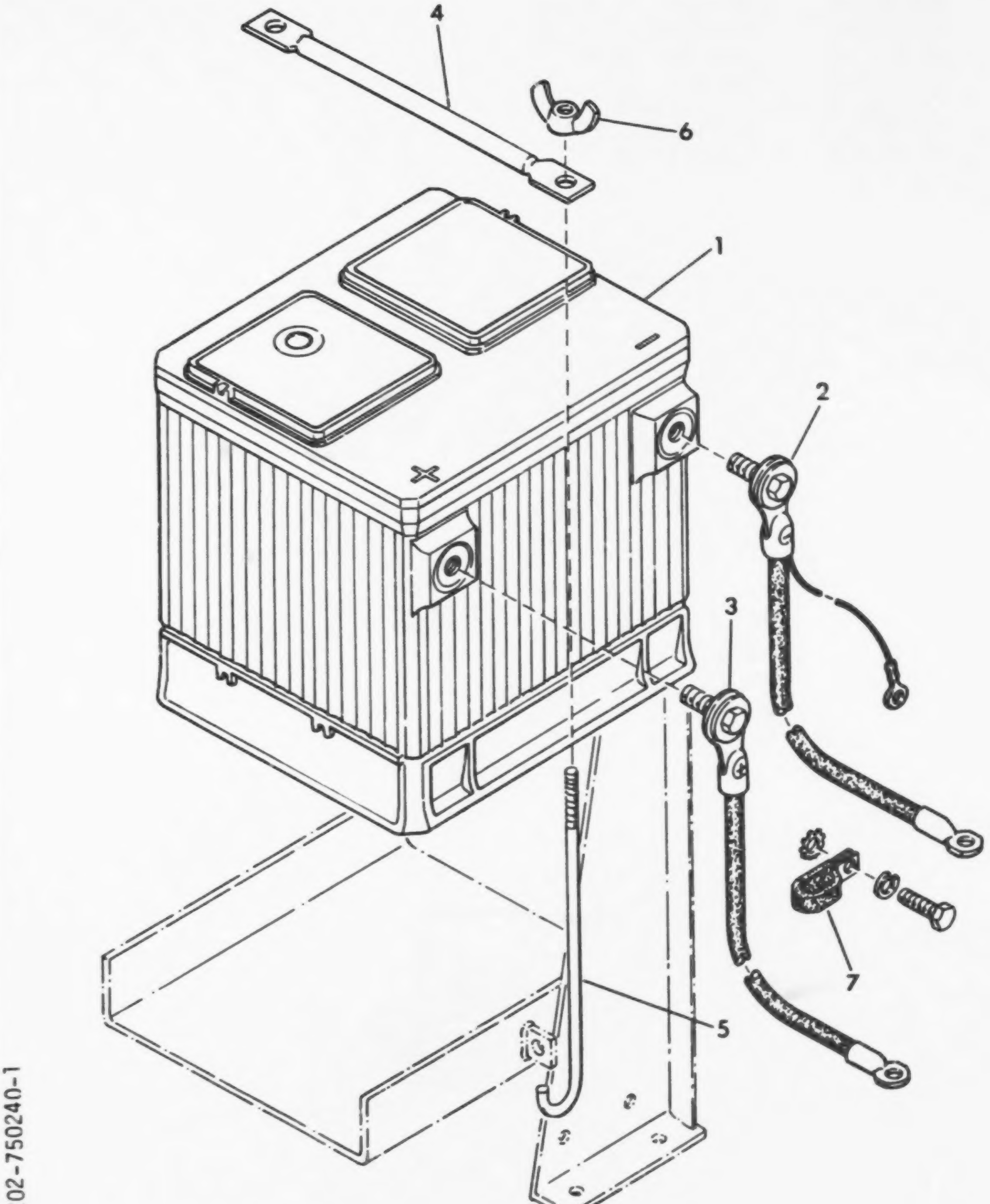
ITEM	PART NO.	DESCRIPTION	QTY.
1	4724733-3	SWITCH	1
2	4727352-9	PLATE-SWITCH	1
3	4724728-3	HOLDER-FUSE	1
4	4757912-3	FUSE-20 AMP	1

HORN

ITEM	PART NO.	DESCRIPTION	QTY.
1	4830173-3	HORN	1
2	4843539-0	WIRE-BLACK-16 GA-16"	1
	4255385-9	TERMINAL-SPADE-#10	1
	4255271-1	TERMINAL-FEMALE	1
3	4721573-6	RELAY-12V	1
	0921960-1	CAPSCREW-.25"-20 X 1"	1
	0916964-0	LOCKWASHER-.25"	1
	0916622-4	NUT-.25"-20	1

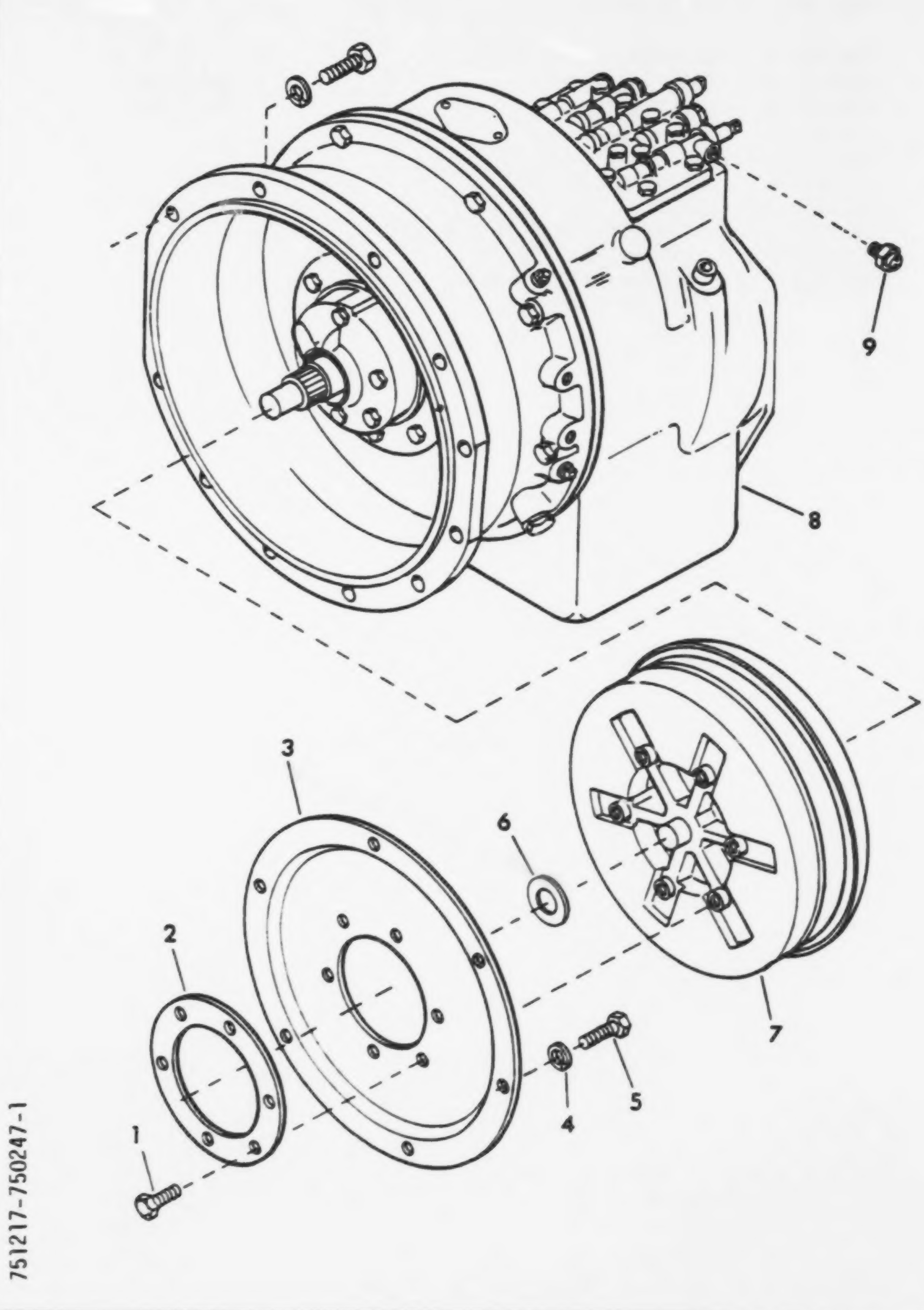


780110-72337-1


790202-750240-1

BATTERY

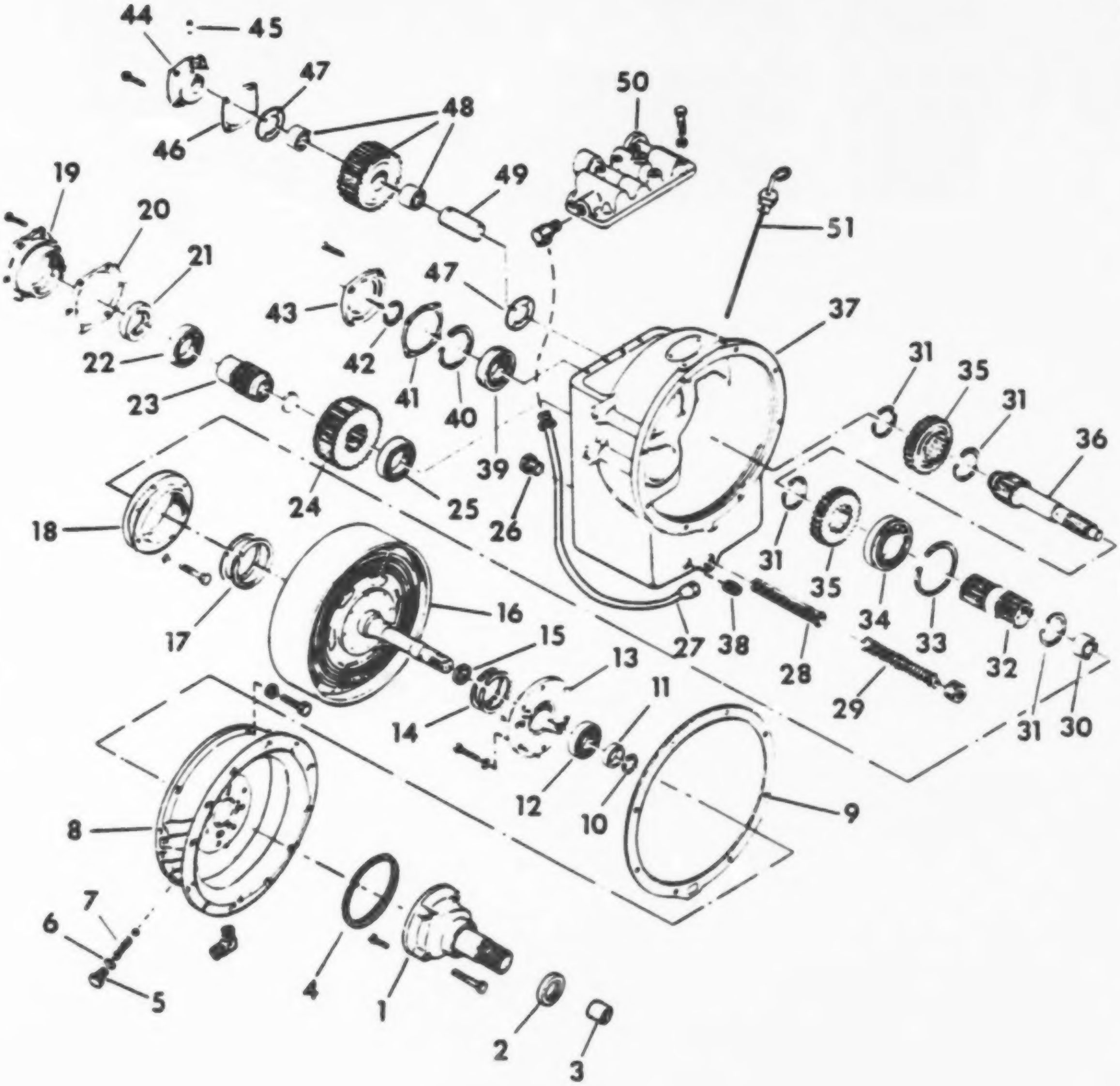
ITEM	PART NO.	DESCRIPTION	QTY.	
1	4889803-5	BATTERY-12V	1	
2	4889783-9	CABLE-BATTERY	1	NEGATIVE
3	4889807-6	CABLE-BATTERY	1	POSITIVE
4	4891874-2	ROD-HOLDOWN	1	
5	4892371-8	ROD	2	
6	0918470-6	NUT-WING-.25"-20	2	
7	0927445-7	CLAMP	1	
	0921210-1	CAPSCREW-.38"-16 X 1.00"	1	
	0916965-7	LOCKWASHER-.38"	1	
	0920427-2	LOCKWASHER-IT-.38"	2	



751217-750247-1

TRANSMISSION-POWER SHIFT

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4752002-8	BOLT-PLATE TO CONVERTOR	6	
2	4755381-3	PLATE-REINFORCING	1	
3	4761032-4	PLATE-DRIVE	1	
4	4755380-5	LOCKWASHER	6	
5	4254864-4	BOLT	6	
6				
7	4884041-7	CONVERTOR-TORQUE	1	
8	4874437-9	TRANSMISSION ASSY	1	SEE PAGE 75
	0921210-1	CAPSCREW-.38"-16 X 1.00"	12	
	0920427-2	LOCKWASHER-.38"	12	
9	4909868-4	SWITCH-NEUTRAL START	1	

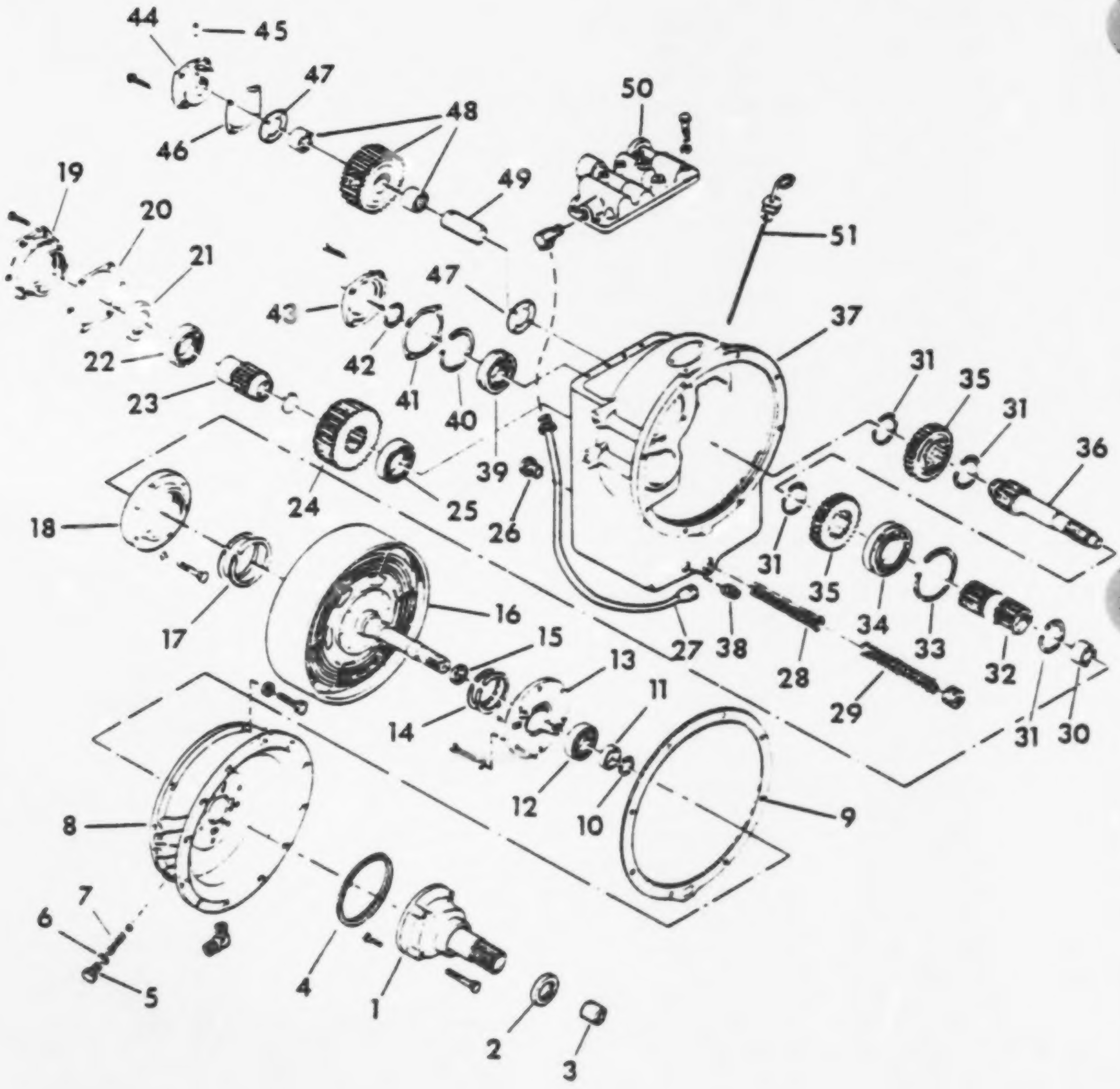

44
45
47
48
50
46
19
49
20
51
21
47
43
42
37
22
41
40
39
31
35
31
23
36
24
25
26
18
31
35
34
33
32
16
15
17
27
38
28
13
11
29
31
30
14
12
10
9
8
7
6
5
4
1
2
3

760497-72232-2

TRANSMISSION ASSY-4874437-9

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4907656-5	PUMP ASSY	1	INCL ITEMS 2-3
	0929543-7	SCREW-.25"-20 X 1.00"	1	
	0923124-2	CAPSCREW-.31"-18 X 2.00"	4	GR 8
2	0927023-2	*SEAL-OIL	1	
3	4912255-9	BUSHING-SUPPORT	1	
4	4907589-6	GASKET-PUMP	1	
5	4991740-7	SEAT-SPRING	1	
6	4991741-2	WASHER-SPRING SEAT	1	
7	4906409-0	SPRING-POP VALVE	1	
	0917146-3	BALL-CHROME STEEL-.44"	1	
8	4909316-4	HOUSING-CONVERTER	1	
	0919134-7	PLUG-PIPE-.13"	3	
	0920131-0	PLUG-PIPE-.38"	1	
	0919224-6	CAPSCREW-.38"-16 X 1.13"	5	
	0921971-8	CAPSCREW-.38"-16 X 1.75"	3	
	0919312-9	LOCKWASHER-.38"	8	
9	4909118-4	*GASKET-TRANS CASE	1	
10	4905790-4	RING-SNAP	1	
11	4905792-0	SPACER-BEARING	1	
12	0067766-6	BEARING	1	
13	4905793-8	RETAINER & PLUG ASSY	1	
	0921333-1	CAPSCREW-.31"-18 X 1.00"	6	
	0917356-8	LOCKWASHER-.31"	6	
14	4987600-6	*RING-SEALING	2	
15	4905788-8	*RING-SEALING	1	
16	4912238-5	CLUTCH ASSY-FWD & REV	1	SEE PAGE 81
17	4995592-5	*RING-SEALING	2	
18	4995595-8	RETAINER-BEARING	1	
	0928075-1	CAPSCREW-.31"-18 X 1.25"	5	INCL LKW
19	4987585-9	RETAINER-BEARING	1	OUTPUT SHAFT
	0926671-9	CAPSCREW-.31"-18 X .88"	4	NYLON COAT
20	4987586-7	*GASKET-BEARING RETAINER	1	
21	4254667-1	*SEAL-OIL	1	
22	4254658-0	BEARING-BALL	1	
23	1002933-8	SHAFT-OUTPUT	1	INCL EXP PLUG
	0910007-4	PLUG-EXPANSION-1.38"	1	
24	4987583-4	GEAR-COUNTERSHAFT	1	
25	4254658-0	BEARING-BALL	1	
26	4912350-8	PLUG-DRAIN	1	INCL GASKET
27	4909917-9	TUBE ASSY	1	VALVE TO CONV
	0917496-2	ELBOW-45°-.38"	1	VALVE END
	0910978-6	ELBOW-90°-.38"	1	CONV END
28	4999354-6	SCREEN-OIL	1	
29	4999355-3	SPRING-OIL SCREEN	1	
	0918888-9	PLUG-RETAINING-1.00"	1	
30	0080325-4	BEARING-NEEDLE	1	
31	4987702-0	RING-SNAP	4	
32	4995594-1	SHAFT-DRIVE-REVERSE	1	
33	4995626-1	RING-SNAP	1	
34	4995627-9	BEARING-BALL	1	
35	4987593-3	GEAR-LOW & REVERSE	2	

CONTINUED

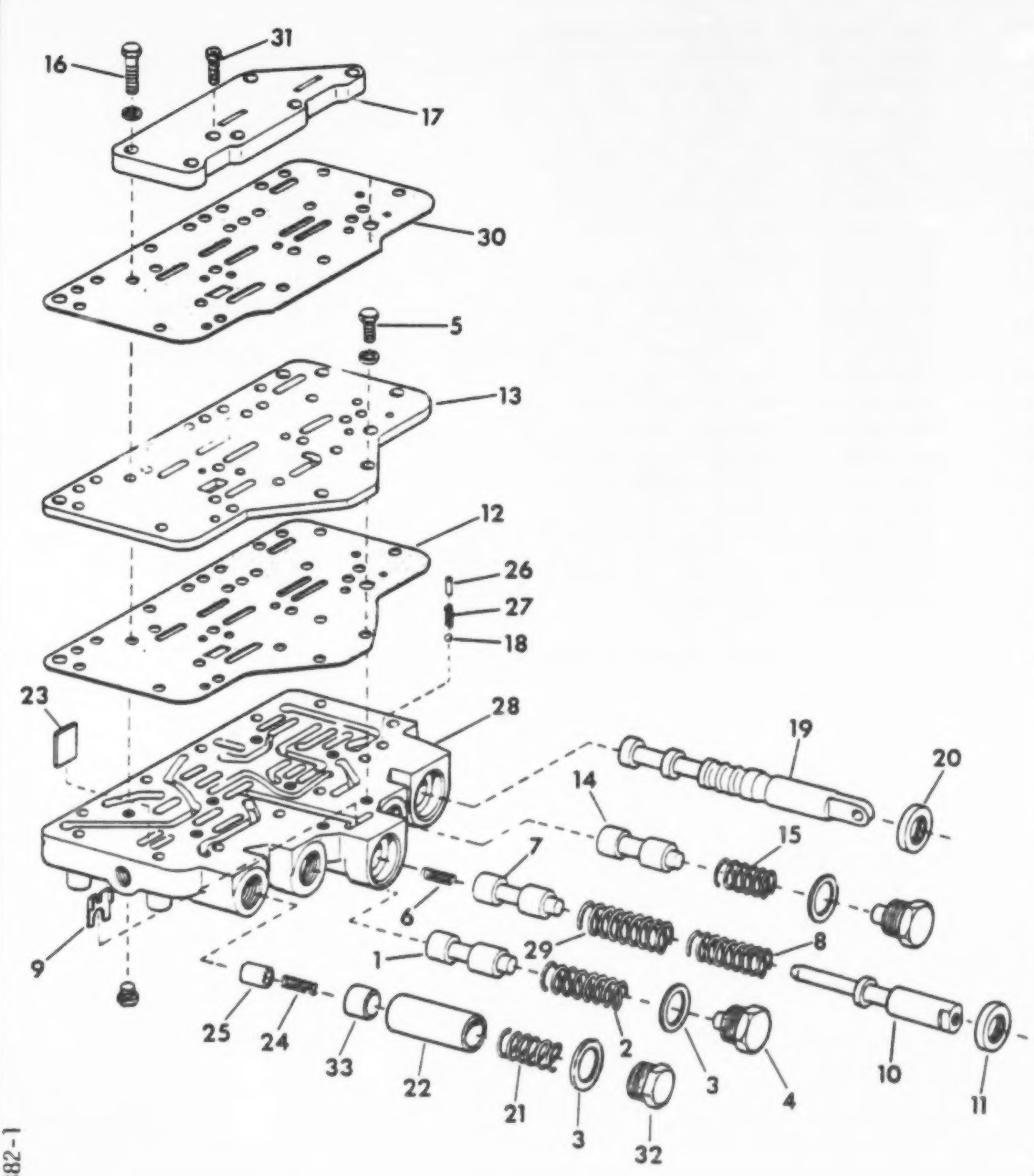

44
45
47
48
46
50
19
49
20
51
21
47
43
37
22
42
41
40
39
31
35
23
31
24
36
25
18
26
31
35
16
34
33
17
15
27
38
28
32
13
11
29
31
30
14
12
10
9
8
7
6
5
4
1
2
3

760497-72232-2

TRANSMISSION ASSY-4874437-9 (CONTINUED)

ITEM	PART NO.	DESCRIPTION	QTY.	
36	4987595-8	SHAFT-DRIVE-FORWARD	1	
37	4909121-8	CASE ASSY-TRANSMISSION	1	INCL PLUGS & ITEM 25
	0918850-9	PLUG-HEX SOC-.25"	1	
	0920130-2	PLUG-SQ HD-.25"	2	
	0920131-0	PLUG-SQ HD-.38"	1	
38	4707650-0	PLUG-DRAIN-MAGNETIC	1	
39	4253543-5	BEARING-BALL	1	
40	1007047-2	RING-SNAP-BEARING	1	
41	4987596-6	*GASKET-RETAINER	1	
42	4987703-8	RING-SNAP	1	
43	4987597-4	RETAINER-BEARING	1	
	0926671-9	CAPSCREW-.31"-18 X .88"	4	NYLON COAT
44	4908325-6	RETAINER-IDLER SHAFT	1	
	0926671-9	CAPSCREW-.31"-18 X .88"	6	NYLON COAT
45	4987589-1	PIN-RETAINING	1	
46	4987590-9	*GASKET-RETAINER	1	
47	4997587-3	WASHER-THRUST	2	
48	4914183-1	GEAR KIT-IDLER	1	INCL BRGS & SPACERS
49	4987588-3	SHAFT-IDLER GEAR	1	
50	4909135-8	VALVE ASSY-TRANS	1	SEE PAGE 79
	0931139-0	CAPSCREW-.31"-18 X 1.13"	1	INCL LKW
	0918066-2	CAPSCREW-.31"-18 X 1.50"	3	
	0931140-8	CAPSCREW-.31"-18 X 2.00"	8	
51	4987644-4	DIPSTICK	1	

*INCL IN KIT 4909869-2

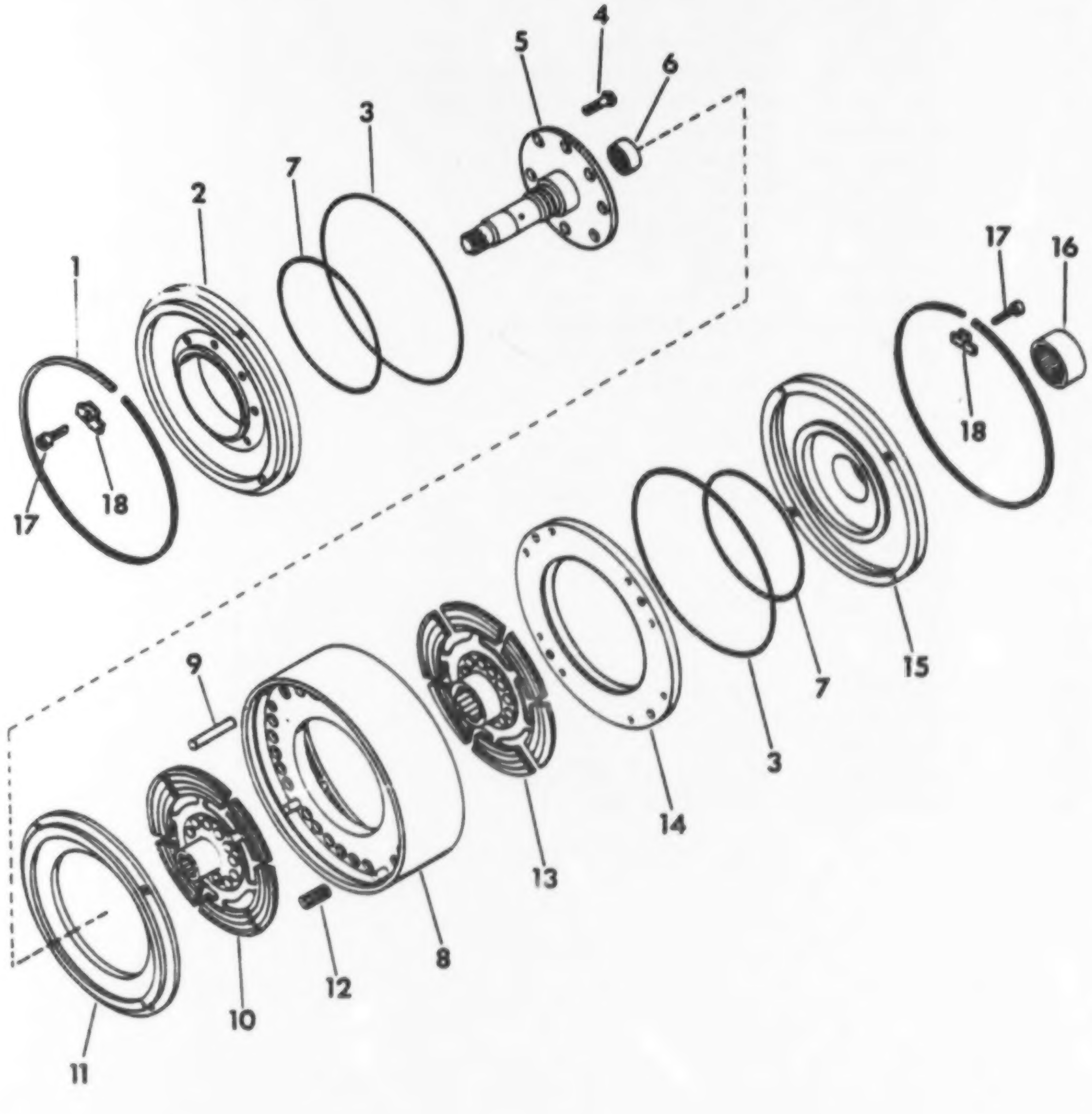

31
16
17
30
5
13
12
26
27
18
23
28
19
20
14
15
7
6
29
8
1
9
25
24
33
22
21
3
32
2
3
4
10
11

760328-741382-1

TRANSMISSION VALVE ASSY-4909135-8

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4909124-2	VALVE-REGULATOR	1	
2	4987631-1	SPRING-REGULATOR VALVE	1	
3	4987634-5	*GASKET	3	
4	4987635-2	SCREW-VALVE RETAINER	2	
5	0915809-8	CAPSCREW-.31"-18 X .75"	2	
	0917356-8	LOCKWASHER-.31"	2	
6	4988062-8	SPRING	1	
7	4909126-7	VALVE-INCHING	1	
8	4991747-9	SPRING-INCHING VALVE-INNER	1	
9	4909127-5	STOP-INCHING VALVE PLUNGER	1	
10	4909128-3	PLUNGER-INCHING VALVE	1	
11	4254697-8	*SEAL-OIL	1	
12	4909129-1	*GASKET-VALVE BODY	1	
13	4910352-6	PLATE-VALVE BODY	1	
14	4987630-3	VALVE-REGULATOR	1	
15	4987673-3	SPRING	1	
16	0918065-4	CAPSCREW-.31"-18 X 1.25"	6	INCL LKW
17	4909131-7	COVER-VALVE BODY	1	
18	0915771-0	BALL-CHROME STEEL-.25"	1	
19	4909132-5	VALVE-SELECTOR	1	
20	4254666-3	*SEAL-OIL	1	
21	4912280-7	SPRING	1	
22	4912281-5	VALVE-CONV REG	1	
23	4909138-2	PLATE-VALVE STOP	1	
24	4909139-0	SPRING	1	
25	4909140-8	VALVE-LUBE REG	1	
26	4909142-4	PIN-INTERLOCK	1	
27	4909134-1	SPRING	1	
28	4909133-3	BODY-VALVE	1	
	0919134-7	PLUG-.12" PT	2	
29	1002963-5	SPRING-INCHING VALVE-OUTER	1	
30	4912284-9	*GASKET-SEPARATOR PLATE	1	
31	4912285-6	SCREW	1	
32	4912282-3	PLUG-VALVE RETAINER	1	
33	4912283-1	PLUG-CONV REG	1	

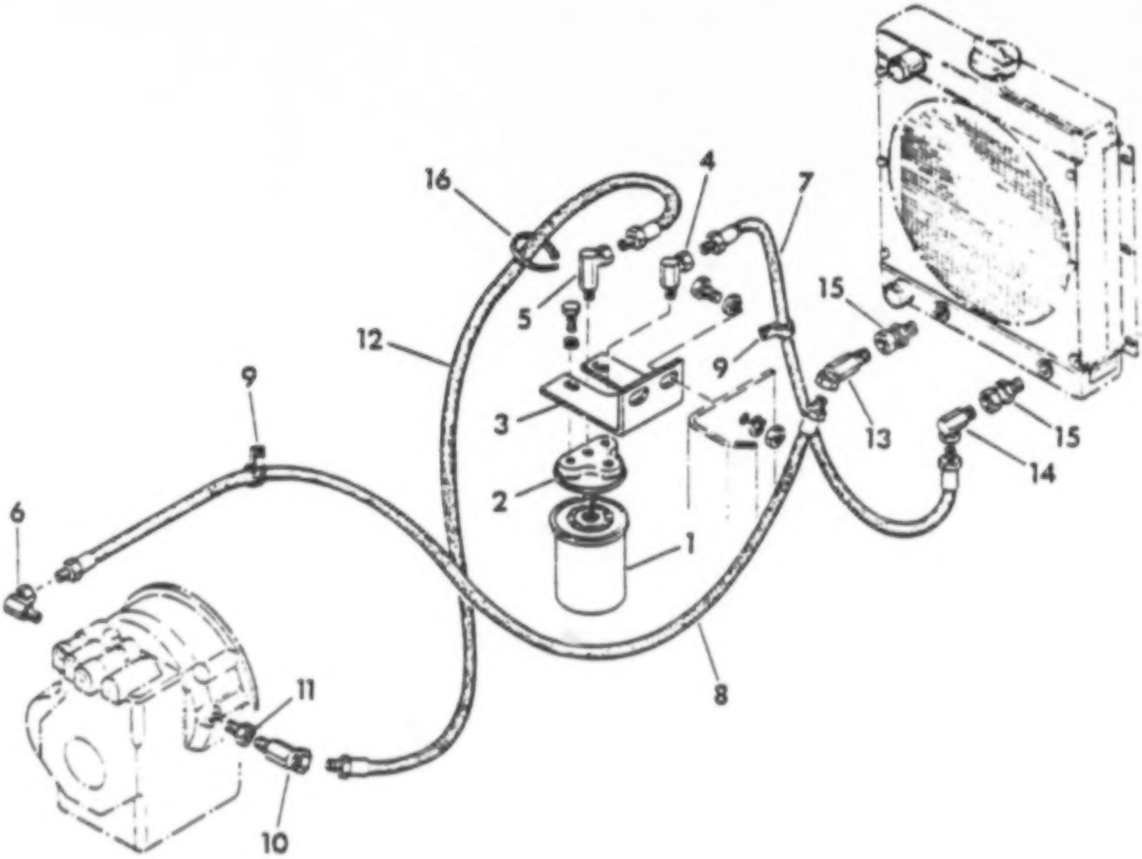
*INCL IN KIT 4909869-2


760327-72347 2

CLUTCH ASSY-FWD & REV-4912238-5

ITEM	PART NO.	DESCRIPTION	QTY	
1	4987609-7	RING-SNAP	2	
2	4912343-3	CYLINDER-FRONT CLUTCH	1	
3	4909119-2	*RING-SEALING	2	
4	4998673-0	BOLT-PLACE	8	
5	4905883-7	SHAFT ASSY-INPUT	1	INCL ITEM 6
6	4254654-9	BEARING-NEEDLE	1	
7	4910086-0	*RING-SEALING	2	
8	4999280-3	PLATE ASSY-PRESSURE	1	INCL ITEM 9
9	4987603-0	PIN-DRIVE-PRESSURE PLATE	4	
10	4912342-5	PLATE ASSY-FWD CLUTCH	1	
11	4912346-6	PISTON-CLUTCH	1	
12	4987611-3	SPRING-CLUTCH RETRACTOR	24	
13	4912345-8	PLATE ASSY-REV CLUTCH	1	
14	4912346-6	PISTON-CLUTCH	1	
15	4912344-5	CYLINDER-REAR CLUTCH	1	
16	4255470-9	BEARING-NEEDLE	1	
17	4996438-0	SCREW	2	
18	4999539-2	PLATE-LOCK-SNAP RING	2	

*INCL IN KIT 4909869-2

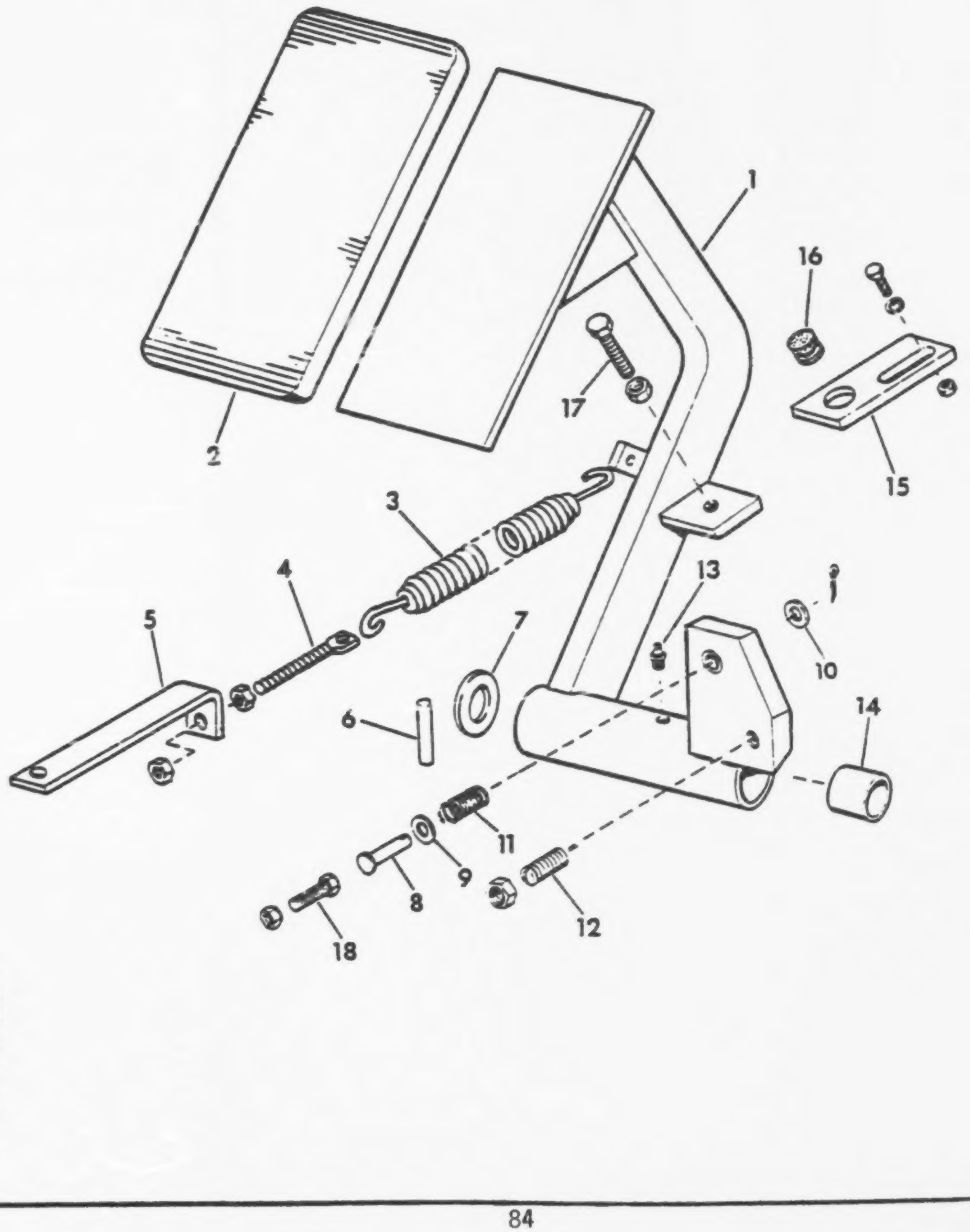

16
4
7
5
15
12
9
9
3
13
15
2
14
6
1
11
8
10

770839-72431-1

TRANSMISSION FILTER-POWER SHIFT

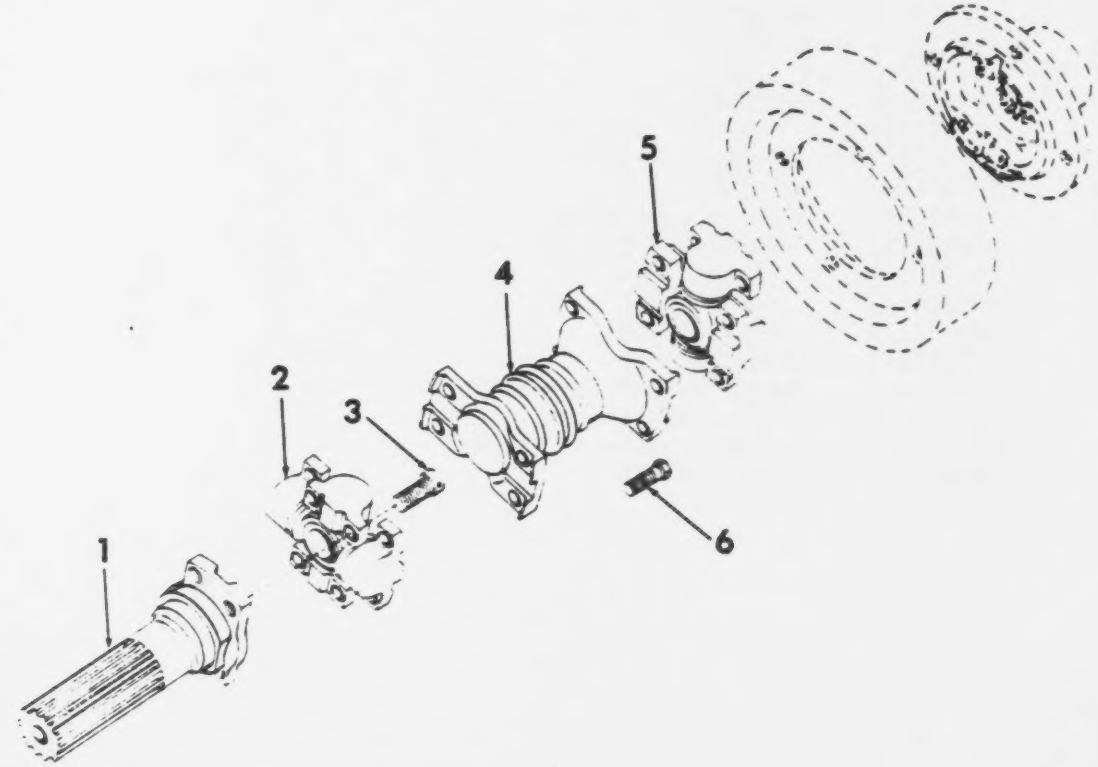
ITEM	PART NO.	DESCRIPTION	QTY.	
1	4511629-0	FILTER	1	
2	4824293-7	BASE-FILTER	1	
	0921980-9	CAPSCREW-.31"-24 X .62"	2	
	0917356-8	LOCKWASHER-.31"	2	
3	4822341-6	BRACKET	1	
	0921332-3	CAPSCREW-.31"-18 X .75"	2	
	0917356-8	LOCKWASHER-.31"	2	
	0929361-4	WASHER-.31" X .62"	2	
	0917372-5	NUT-.31"-18	2	
4	0926955-6	ADAPTOR-90 DEG	1	
5	4708605-3	ELBOW-LONG	1	
6	0925600-9	ADAPTOR-90 DEG	1	
7	4769239-7	HOSE-51.00"	1	TO RADIATOR
8	4760448-3	HOSE-35.50"	1	FROM RADIATOR
9	0928656-8	CLAMP	2	
10	4811136-3	ADAPTOR-45 DEG	1	
11	0901826-8	BUSHING-PIPE-.38" X .25"	1	
12	4750170-5	HOSE-30.00"	1	TO TRANSMISSION
13	4252647-5	ADAPTOR-45 DEG	1	
14	0931783-5	ADAPTOR-90 DEG	1	
15	4252197-1	ADAPTOR-ST THD	2	
16	4255355-2	TY-RAP	2	

770839-72431-1


770349-750300-1

INCHING CONTROL

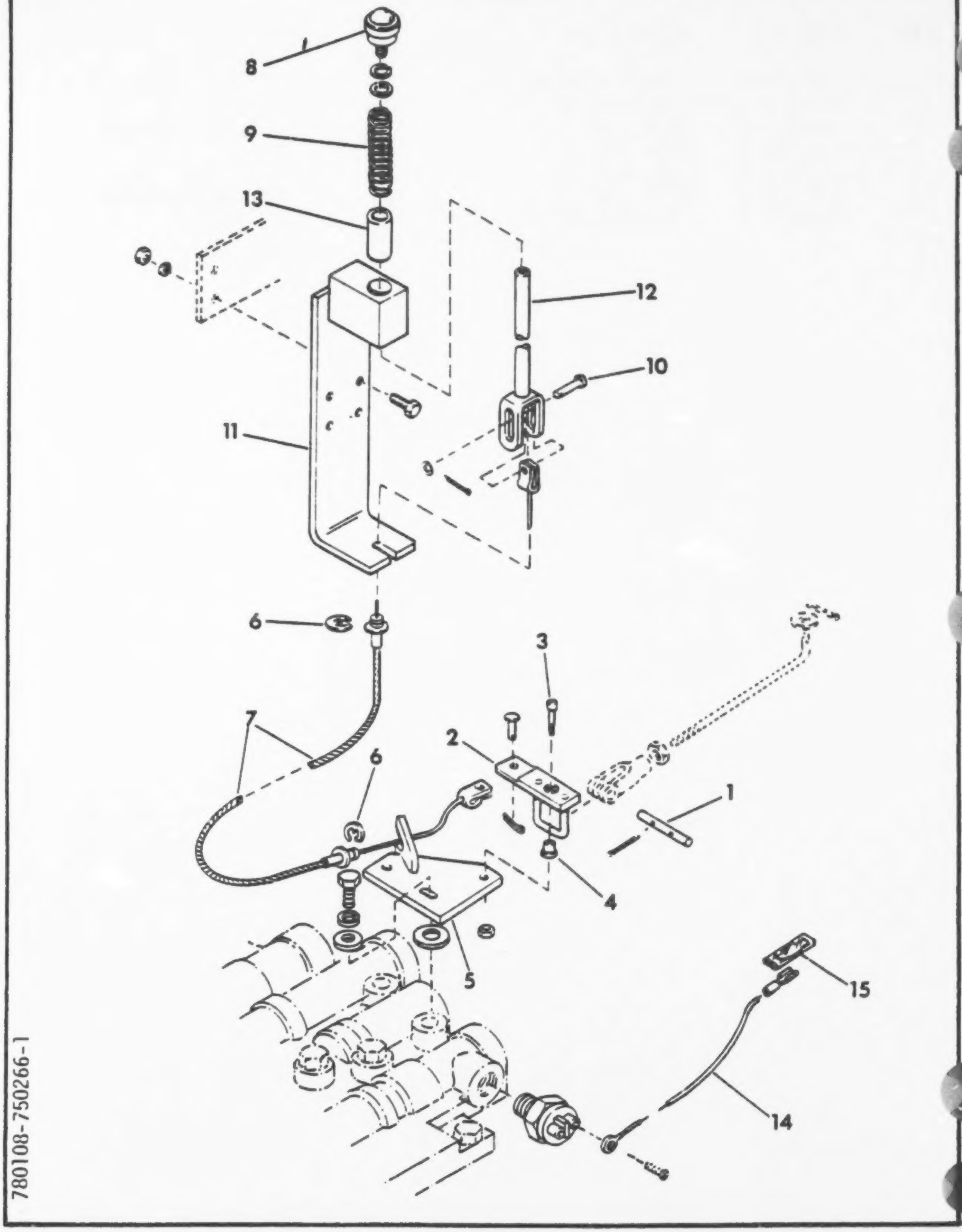
ITEM	PART NO.	DESCRIPTION	QTY.	
1	4857249-9	PEDAL ASSY	1	INCL ITEM 14
2	4869251-1	PAD	1	
3	4814702-9	SPRING	1	
4	4511898-1	EYEBOLT	1	
	0920263-1	NUT-.31"-24	2	
5	4858181-3	BRACKET-SPRING	1	
6	0916004-5	ROLL-PIN-.18" X 2.00"	1	
7	0923870-0	WASHER-1.16"	2	
8	4876715-6	PIN-HEADED	1	
	0918451-6	PIN-COTTER-.13" X .75"	1	
9	0918267-6	WASHER-.47" X .94"	1	
10	0919386-3	WASHER-.47" X 1.00"	1	
11	4868432-8	SPRING	1	
12	0919350-9	SETSCREW-.50"-13 X 2.00"	1	
	0913744-9	NUT-JAM-.50"-13	1	
13	0912808-3	FITTING-LUBE-STD-.25"-28	1	
14	4707331-7	BUSHING	2	
15	4893255-2	STOP-INCHING PEDAL	1	
	0921333-1	CAPSCREW-.31"-18 X 1.00"	2	
	0917356-8	LOCKWASHER-.31"	2	
	0918265-0	WASHER-.31"	2	
	0917372-5	NUT-.31"-18	2	
16	4720549-7	GROMMET	1	
17	0921348-9	CAPSCREW-.38"-16 X 2.50"	1	
	0917421-0	NUT-.38"-16	1	
18	0921982-5	CAPSCREW-.31"-24 X 1.25"	1	
	0920263-1	NUT-.31"-24	1	



71391

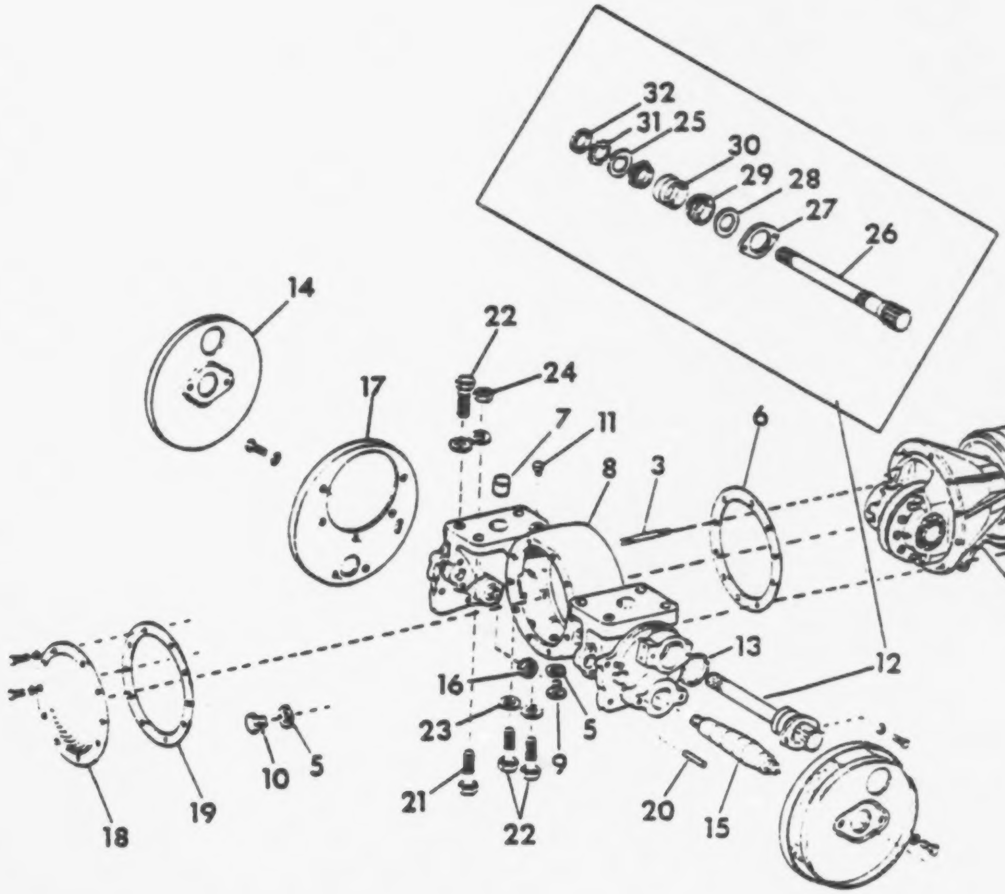
UNIVERSAL JOINT
POWER SHIFT

ITEM	PART NO.	DESCRIPTION	QTY.	
-	4858996-4	JOINT-UNIVERSAL	1	INCL ITEMS 2-4-5 & 6
1	4751804-8	FLANGE-OUTPUT	1	
2	4984504-3	CROSS ASSY	1	INCL BEARINGS
3	4829299-9	CAPSCREW	8	
4	4909863-5	TUBE ASSY	1	
5	4984504-3	CROSS ASSY	1	INCL BEARINGS
6	4829299-9	CAPSCREW-.31"-24 X .75"	8	GR 8


780108-750266-1

RETURN TO NEUTRAL

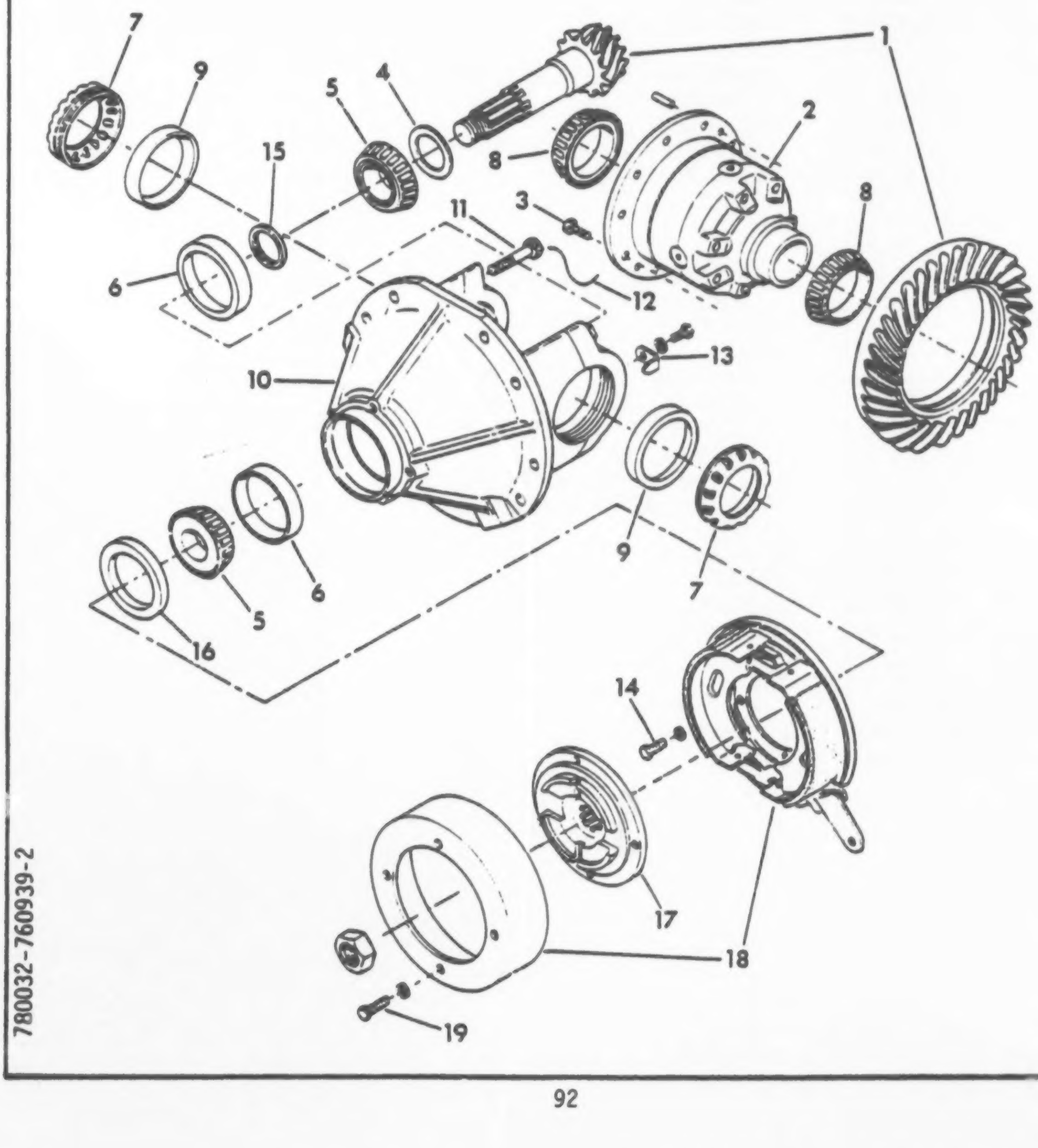
ITEM	PART NO.	DESCRIPTION	QTY.	
1	4842815-5	PIN-CLEVIS	1	
	0919313-7	PIN-COTTER-.09" X .50"	2	
2	4861733-6	ACTUATOR ASSY	1	
3	4836109-1	BOLT-SHOULDER	1	
	0920435-5	NUT-.25"-20	1	
4	4861910-0	BUSHING	1	
5	4861739-3	BASE ASSY	1	
	0921719-1	CAPSCREW-.31"-18 X 2.50"	2	
	0917356-8	LOCKWASHER-.31"	2	
	0919381-4	WASHER-.34" X 1.00"	3	
6	4255183-8	RING-E	2	
7	4862524-8	CABLE UNIT	1	
	0924229-8	PIN-.25"	1	
	0919313-7	PIN-COTTER-.09" X .50"	1	
8	4842160-8	CASTOR	1	
	0916964-0	LOCKWASHER-.25"	1	
	0929359-8	WASHER-.27" X .75"	1	
9	4834731-4	SPRING-COMPRESSION	1	
10	0924025-0	PIN-CLEVIS-.25" X 1.25"	1	
	0918447-4	PIN-COTTER-.09" X .75"	1	
	0921759-7	WASHER-.25" X .56"	1	
11	4861729-4	BRACKET ASSY	1	INCL ITEM 13
	0923325-5	CAPSCREW-.31"-18 X .88"	2	
	0917356-8	LOCKWASHER-.31"	2	
	0917372-5	NUT-.31"-18	2	
12	4861736-9	ROD ASSY	1	
13	4861727-8	BUSHING	1	
14	---------	WIRE-BLACK-16 GA-9.00"	2	
	4408654-1	TERMINAL-RING-#10	2	
	4255271-1	TERMINAL-FEMALE	2	
15	4255521-9	CONNECTOR-LINE	1	


32
31
25
30
29
28
27
26
14
22
24
17
7
11
8
3
6
4
2
1
13
12
16
5
23
9
10
5
21
22
20
15
18
19

780220-71427-2

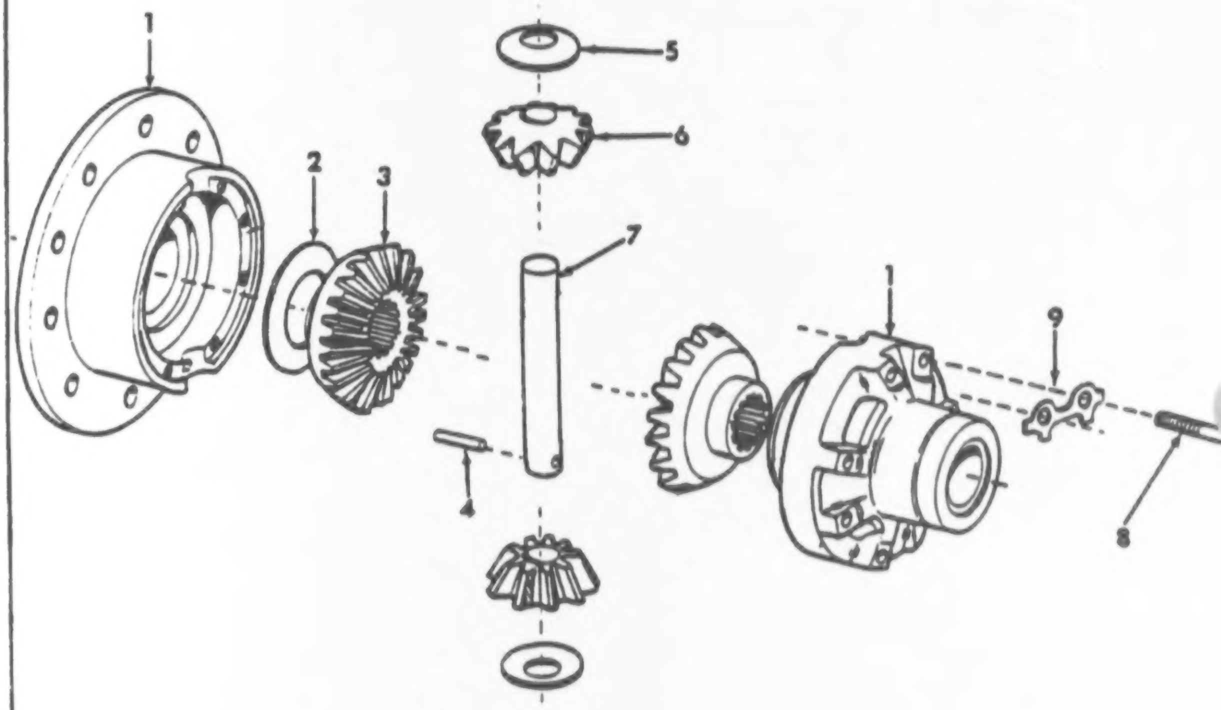
DRIVE AXLE

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4838338-4	CARRIER ASSY	1	SEE PAGE 93
2	4751644-8	BOLT	8	
3	4751985-5	STUD	2	
4	4751627-3	LOCKNUT	2	
5	4845678-4	WASHER-NYLON	2	
6	4707440-6	GASKET	1	
7	4832944-5	PIN-SHEAR	2	
8	4744948-3	HOUSING	1	
9	4855689-8	PLUG	1	
10	4847837-4	PLUG	1	
11	4710092-0	BREATHER	1	
12	4797273-2	SHAFT ASSY	2	INCL ITEMS 25 THRU 32
13	4501458-6	SEAL	2	
	0921210-1	CAPSCREW-.38"-16 X 1.00"	4	
	0916965-7	LOCKWASHER-.38"	4	
14	4707060-2	SHIELD-DUST	2	
	0921958-5	CAPSCREW-.25"-20 X .50"	4	
	0916964-0	LOCKWASHER-.25"	4	
15	4787365-8	SPINDLE	2	
16	4747109-9	NUT	2	
17	4847694-9	PLATE	2	
	0921332-3	CAPSCREW-.31"-18 X .75"	10	
	0917356-8	LOCKWASHER-.31"	10	
18	4710053-2	COVER	1	
19	4716827-3	GASKET	1	
	0926594-3	CAPSCREW-.31"-18 X .75"	8	
	0926593-5	CAPSCREW-.31"-18 X .50"	2	
	0917356-8	LOCKWASHER-.31"-18 X .75"	10	
20	0918567-9	PIN-.44" X .88"	4	
21	0922519-4	SCREW-TWELVE PT-.88"-9 X 2.00"	2	
22	0925806-2	CAPSCREW-.88"-9 X 3.00"	6	
23	4856321-7	WASHER	14	
24	0930334-8	NUT-.88"-9	6	
25	4254773-7	WASHER	2	
26	4795884-8	SHAFT-PINION	2	
27	4707234-3	CAP	2	
28	4253297-8	SEAL	2	
29	4253254-9	CONE	4	
30	4253253-1	CUP	2	
31	4253299-4	LOCKWASHER	2	
32	4331040-8	LOCKNUT	2	


780032-760939-2

CARRIER ASSY-4838338-4

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4838336-8	GEAR ASSY	1	2.25:1 RATIO
	0917611-6	PIN-GROOVED-.38" X .75"	2	
2	4839704-6	DIFFERENTIAL ASSY	1	SEE PAGE 95
3	0931130-9	BOLT-.38"-24 X .62"	10	
4	4818848-6	SHIM-.002"	*	USE AS REQUIRED
	4818849-4	SHIM-.003"	*	
	4818850-2	SHIM-.005"	*	
	4818851-0	SHIM-.010"	*	
	4818852-8	SHIM-.020"	*	
5	0632465-1	CONE	2	
6	0632466-9	CUP	2	
7	4839703-8	NUT-BEARING	2	
8	0927270-9	CONE	2	
9	0927273-3	CUP	2	
10	4873388-5	HOUSING	1	INCL CAP & ITEM 11
11	4377201-1	CAPSCREW	4	
12	4737615-7	LOCKWIRE	2	
13	4838778-1	LOCK	2	
	0925205-7	CAPSCREW-.31"-18 X .62"	2	
	0917356-8	LOCKWASHER-.31"	2	
14	0916711-5	CAPSCREW-GR8-HEX-SOC-.31"-18 X .62"	4	
	0917356-8	LOCKWASHER-.31"	4	
15	4873387-7	RING-LOAD	1	
16	4254912-1	SEAL	1	
17	4749684-9	FLANGE	1	
	0933081-2	NUT-LOCK-1.00"-14	1	
18	4747691-6	BRAKE-PARKING	1	SEE PAGE 107
19	4823231-8	CAPSCREW	4	
	0924607-5	WASHER-.41" X 1.50"	4	

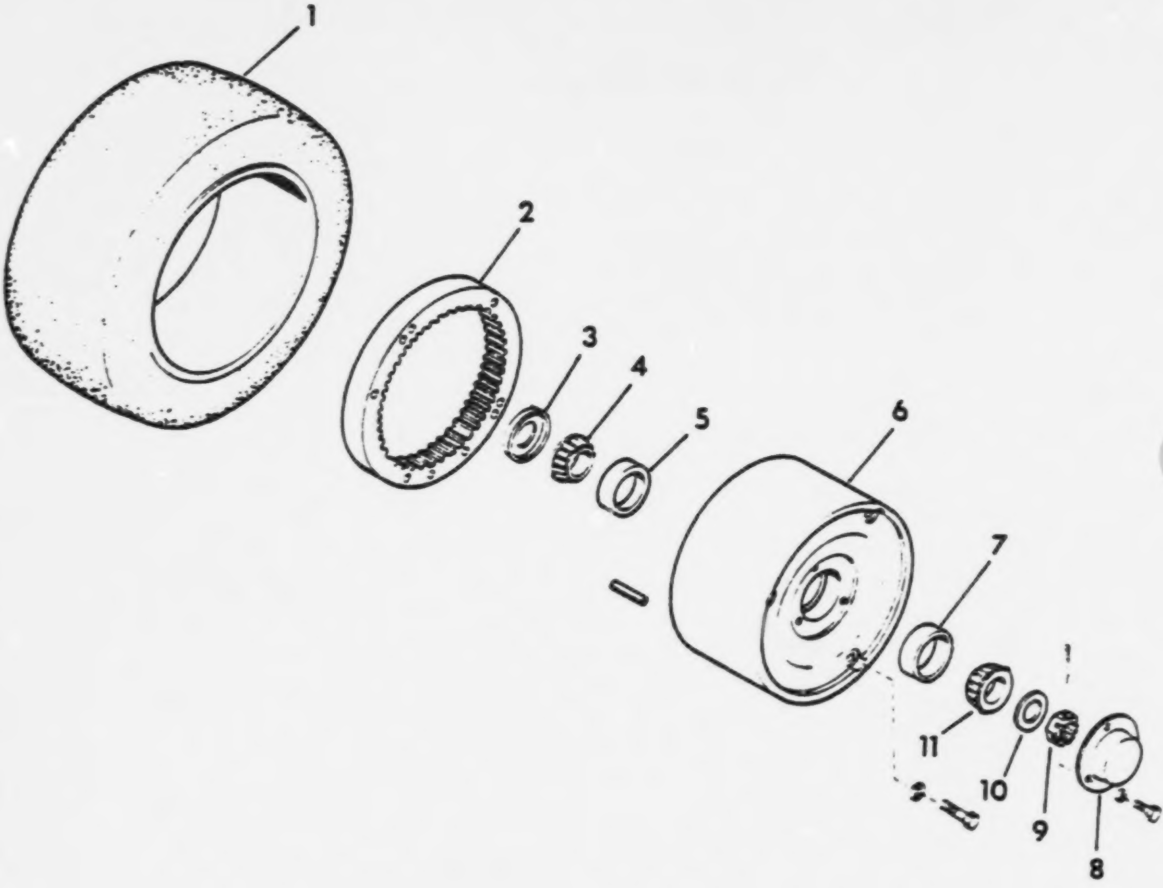

1
5
6
2
3
7
1
9
4
8

71369

DIFFERENTIAL ASSY-4839704-6

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4908941-0	CASE KIT-DIFFERENTIAL	1	INCL ITEM 8 & 9
2	4707712-8	*SPACER-SIDE GEAR	2	
3	4906401-7	*GEAR-SIDE	2	
4	0917023-4	*PIN-DOWEL-.25" X 1.00"	1	
5	4707711-0	*SPACER-PINION GEAR	2	
6	4906403-3	*GEAR-PINION	2	
7	4906406-3	*PIN-CROSS	1	
8	0913599-7	CAPSCREW-.31"-18 X 2.50"	8	
9	4906404-1	CLIP-RETAINING	4	

*INCL IN KIT 4907245-7


7 1 27·1

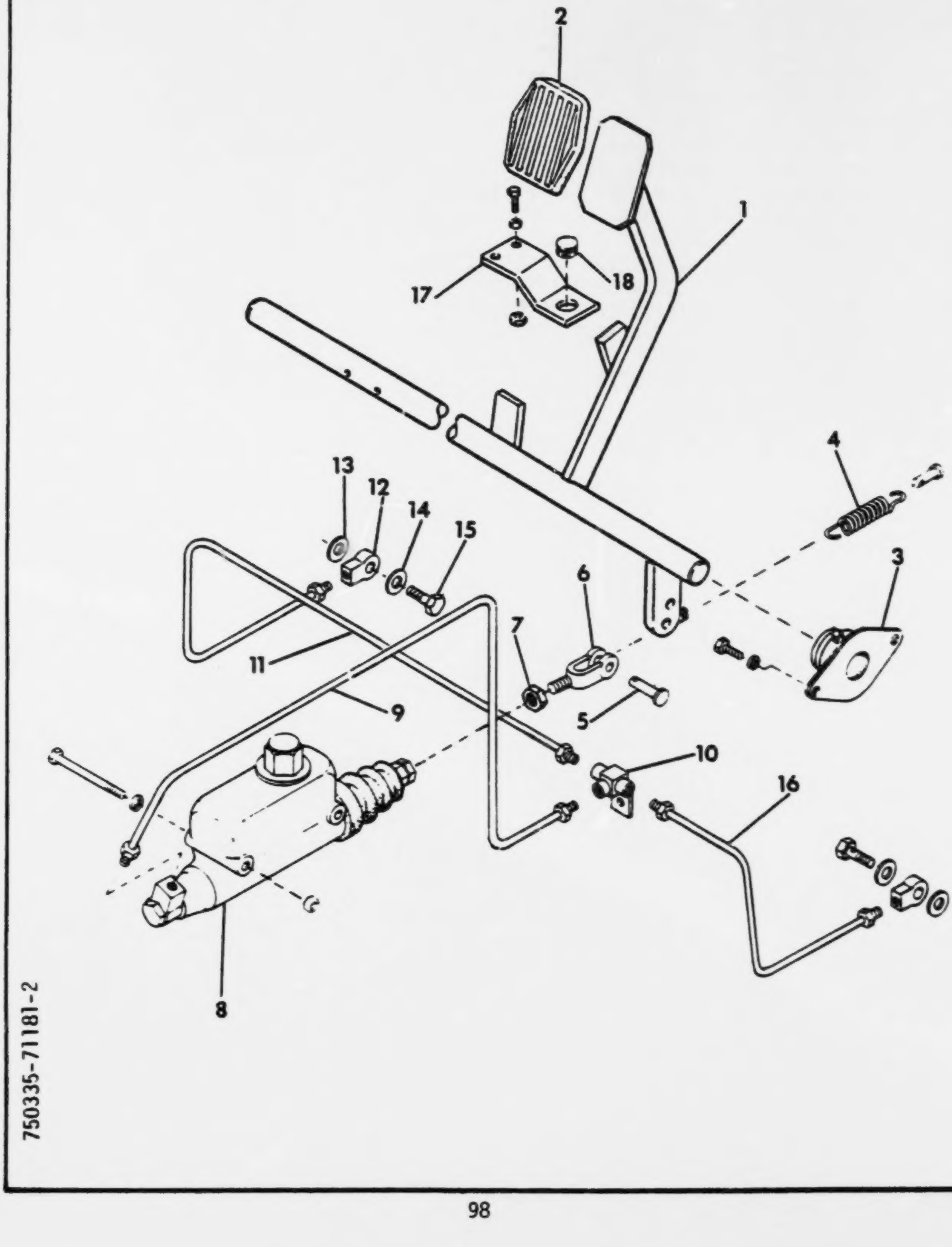
DRIVE WHEEL

ITEM	PART NO.	DESCRIPTION	QTY.
1	4713963-9	TIRE	2
2	4795693-3	GEAR	2
	0918782-4	PIN-ROLL-.44" X 2.75"	6
	0921973-4	CAPSCREW-.38"-16 X 2.75"	6
	0916965-7	LOCKWASHER-.38"	6
3	4707059-4	SHIELD	2
4	4253050-1	CONE-INNER	2
5	4250061-1	CUP-INNER	2
6	4761006-8	WHEEL-DRIVE	2
	0924060-7	PIN-STR-.44" X .25"	6
7	4254038-5	CUP-OUTER	2
8	4706891-1	CAP-HUB	2
	0921965-0	CAPSCREW-.38"-16 X .75"	6
	0916803-0	LOCKWASHER-INT-.38"	6
9	0929607-0	NUT-SLOTTED-JAM-1.25"-12	2
	0925719-7	PIN-COTTER-.12" X 2.00"	2
10	4755930-7	WASHER	2
11	4254037-7	CONE-OUTER	2

best copy available

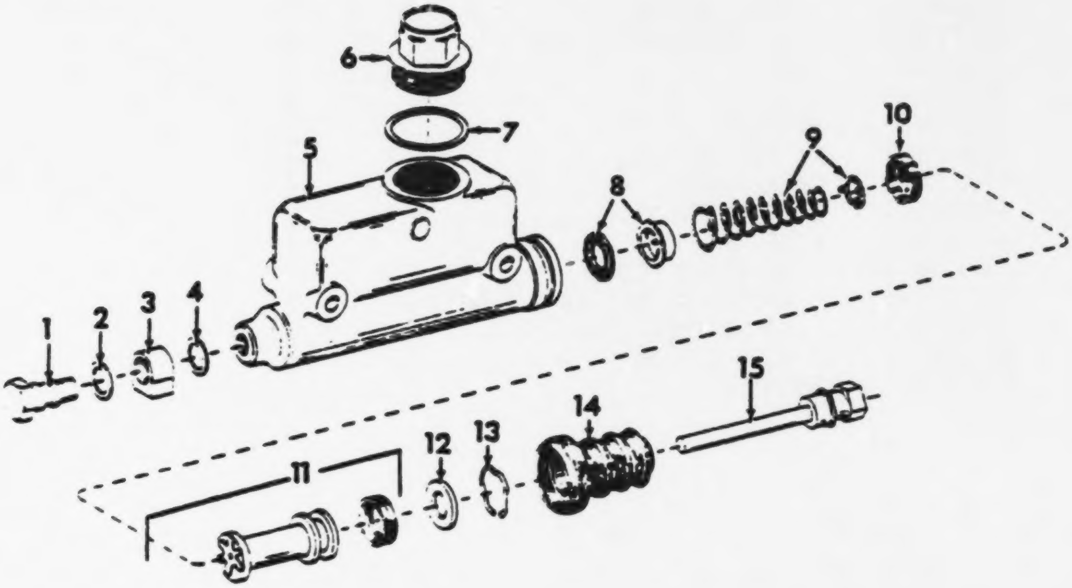
71274

Reproduced from poor document.


750335-71181-2

BRAKE PEDAL

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4857358-8	PEDAL ASSY	1	
2	4824664-9	PAD	1	
3	4784266-1	BEARING-SELF-ALIGNING	2	INCL FITTING
	0914965-0	FITTING-LUBE-STR-.12" PT	2	
	0921965-0	CAPSCREW-.38"-16 X .75"	4	
	0916965-7	LOCKWASHER-.38"	4	
4	4734450-2	SPRING-PEDAL RETURN	1	
	0929590-8	PIN-HEADED-.31" X 1.25"	1	
5	0929592-4	PIN-YOKE-.44" X 1.19"	1	
	0918447-4	PIN-COTTER-.09" X .75"	1	
6	4784720-7	YOKE	1	
7	0922471-8	NUT-.44"-20	1	
8	4713374-9	CYLINDER-MASTER	1	SEE PAGE 101
	0922918-8	CAPSCREW-.38"-16 X 3.25"	2	
	0916965-7	LOCKWASHER-.38"	2	
	0916950-9	NUT-.38"-16	2	
9	4857193-9	LINE-CYLINDER TO TEE	1	
10	4710934-3	TEE	1	
11	4823283-9	LINE-LH	1	
12	4747196-6	FITTING	2	
13	4708319-1	GASKET-FITTING	2	
14	4708318-3	GASKET-BOLT	2	
15	4708313-4	BOLT-FITTING	2	
16	4823285-4	LINE-RH	1	
17	4879296-4	STOP-BRAKE PEDAL	1	
	0921333-1	CAPSCREW-.31"-18 X 1.00"	2	
	0917356-8	LOCKWASHER-.31"	2	
	0917372-5	NUT-.31"-18	2	
18	4720549-7	GROMMET	1	


71385

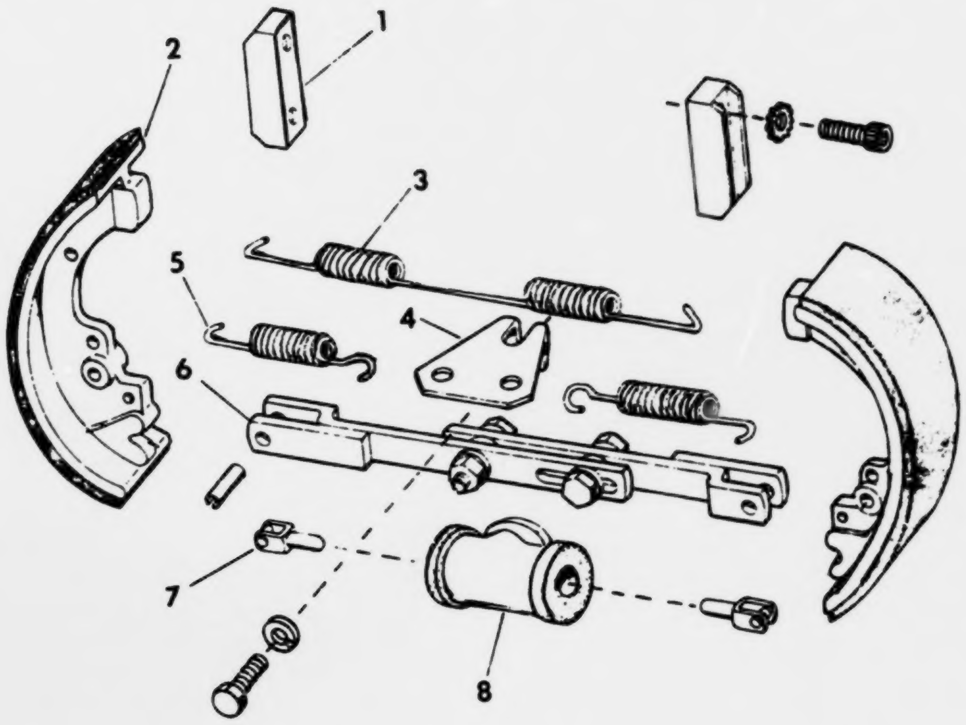
BRAKE MASTER CYLINDER - 4713374-9

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4708313-4	BOLT - FITTING	1	
2	4708319-1	GASKET - BOLT	1	
3	4741699-5	FITTING- OUTLET	1	
4	4708318-3	GASKET - FITTING	1	
5	NSS	BODY - CYLINDER	1	ORDER ASSY 4713374-9
6	4984159-6	CAP - FILLER	1	
7	4981084-9	GASKET - CAP	1	
8	4984141-4	*VALVE ASSY	1	INCL SEAL
9	4984142-2	SPRING ASSY - PISTON	1	INCL RETAINER
10	4984152-9	*CUP - PISTON	1	
11	4984153-9	*PISTON ASSY	1	
12	4984155-4	*PLATE - STOP	1	
13	4984156-2	*LOCK	1	
14	4984157-0	*BOOT	1	
15	4984158-8	ROD - PISTON	1	
16	4984201-6	KIT - REPAIR	1	INCL ITEMS MARKED *

*SERVICED ONLY WITH ITEM 16

DRIVE WHEEL BRAKES

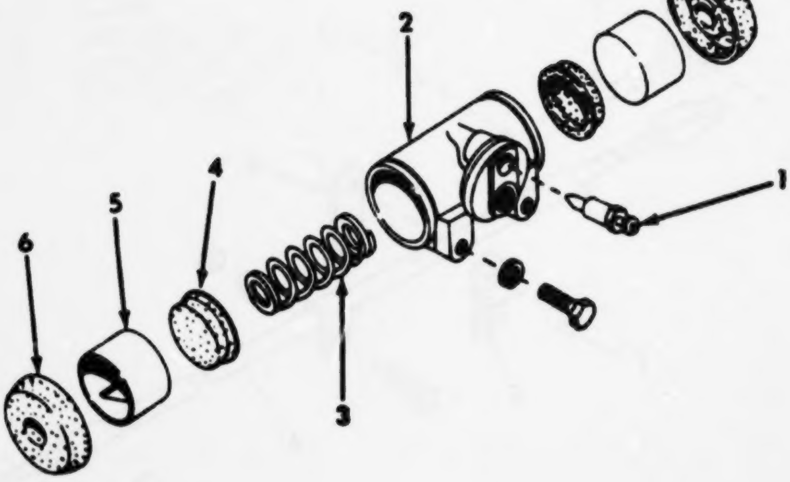
ITEM	PART NO.	DESCRIPTION	QTY.	
1	4808402-4	PLATE - WEAR	4	
	0921958-5	SCREW - .25" -20 X .62"	8	
	4710809-7	LOCKWASHER	8	
2	4873421-7	SHOE & LINING ASSY	4	
3	4719642-3	SPRING	2	
4	4769886-5	BRACKET	2	
	0912264-9	CAPSCREW -.31" - 18 X 1"	2	
	0917356-8	LOCKWASHER -.31"	2	
5	4769885-7	SPRING	4	
6	4769887-3	SLIDE ASSY	2	
	0916169-6	PIN - SPRING -.19" X .75"	4	
7	4707307-7	LINK	4	
8	4717072-5	CYLINDER ASSY - WHEEL	2	SEE PAGE 103
	0921966-8	CAPSCREW -.38" - 16 X .88"	4	
	0916965-7	LOCKWASHER -.38"	4	



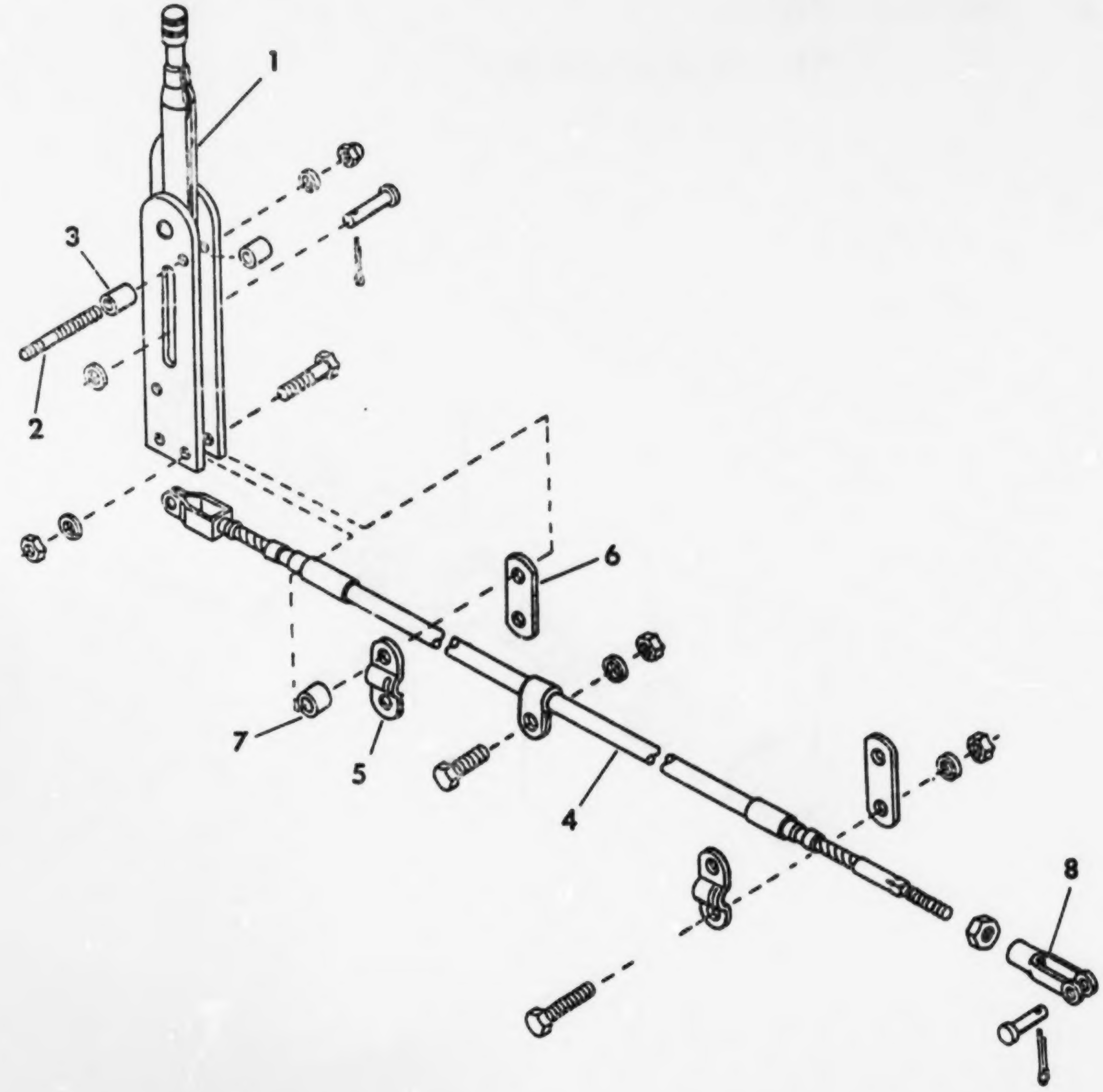
WHEEL CYLINDER - 4717072-5

ITEM	PART NO.	DESCRIPTION	QTY.
1	4981769-5	BLEEDER	1
2	4981289-4	BODY	1
3	4981290-2	SPRING	1
4	4981291-0	*CUP-PISTON	2
5	4981292-8	PISTON	2
6	4987791-3	*BOOT	2

*INCLUDED IN KIT 4987792-1



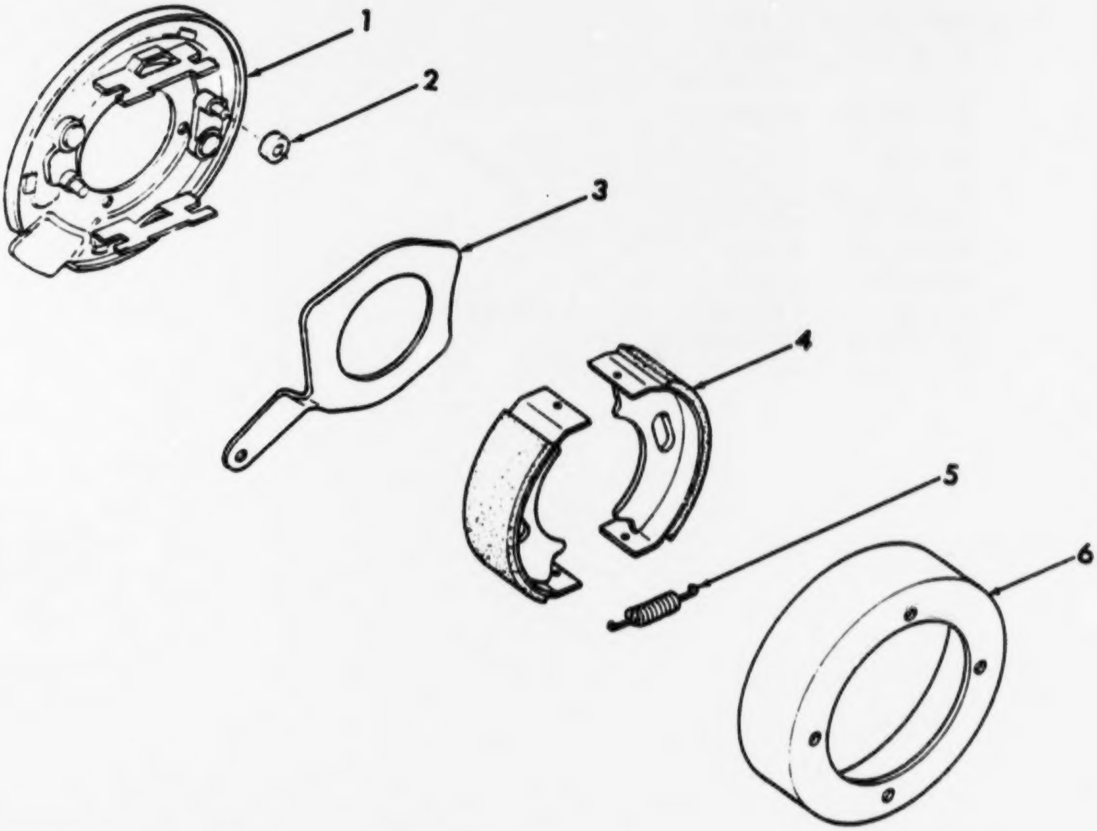
53725



73515

PARKING BRAKE LEVER

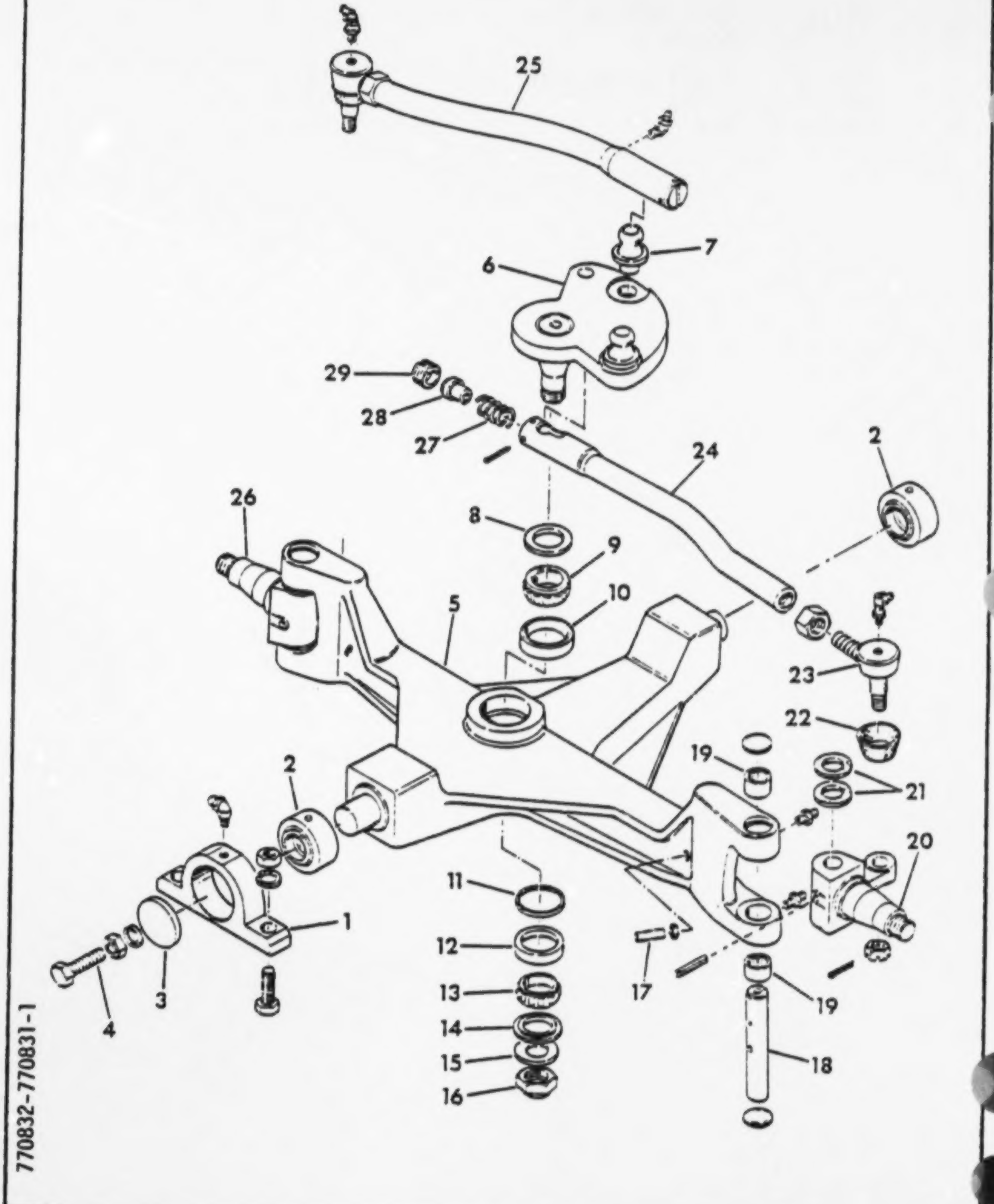
ITEM	PART NO.	DESCRIPTION	QTY.
1	4722511-5	LEVER	1
2	4707401-8	SPACER	2
3	0929522-1	CAPSCREW-.31"-24 X 1.88"	2
4	4255481-6	NUT-SPLINE-.31"-24	2
5	4884230-6	CABLE-BRAKE	1
6	0916602-6	NUT-.38"-24	1
7	0924121-7	YOKE-.38"	1
8	0923087-1	PIN-YOKE-.38"	1
9	0918448-2	PIN-COTTER-.06" X1.00"	1
10	4507415-0	PLATE	1
11	4884222-3	CLAMP	1
12	4750203-4	SPACER	2
13	0921221-8	CAPSCREW-.31"-18 X 1.50"	2
14	0917356-8	LOCKWASHER-.31"	2
15	0917372-5	NUT-.31"-18	2
16	0921980-4	CAPSCREW-.31"-24 X .62"	1
17	0917356-8	LOCKWASHER-.31"	1
18	4255481-6	NUT-SPLINE-.31"-24	1
19	4507415-0	PLATE	1
20	4884222-3	CLAMP	1
21	0921977-5	CAPSCREW-.31"-18 X 1.25"	2
22	0917356-8	LOCKWASHER-.31"	2
23	0917372-5	NUT-.31"-18	2



72112

PARKING BRAKE-4747691-6

ITEM	PART NO.	DESCRIPTION	QTY.
1	4987572-7	PLATE-BACKING	1
2	4987575-0	ROLLER	2
3	4987574-3	LEVER	1
4	4987578-4	SHOE & LINING ASSY	2
5	4987579-2	SPRING	2
6	4747693-2	DRUM	1

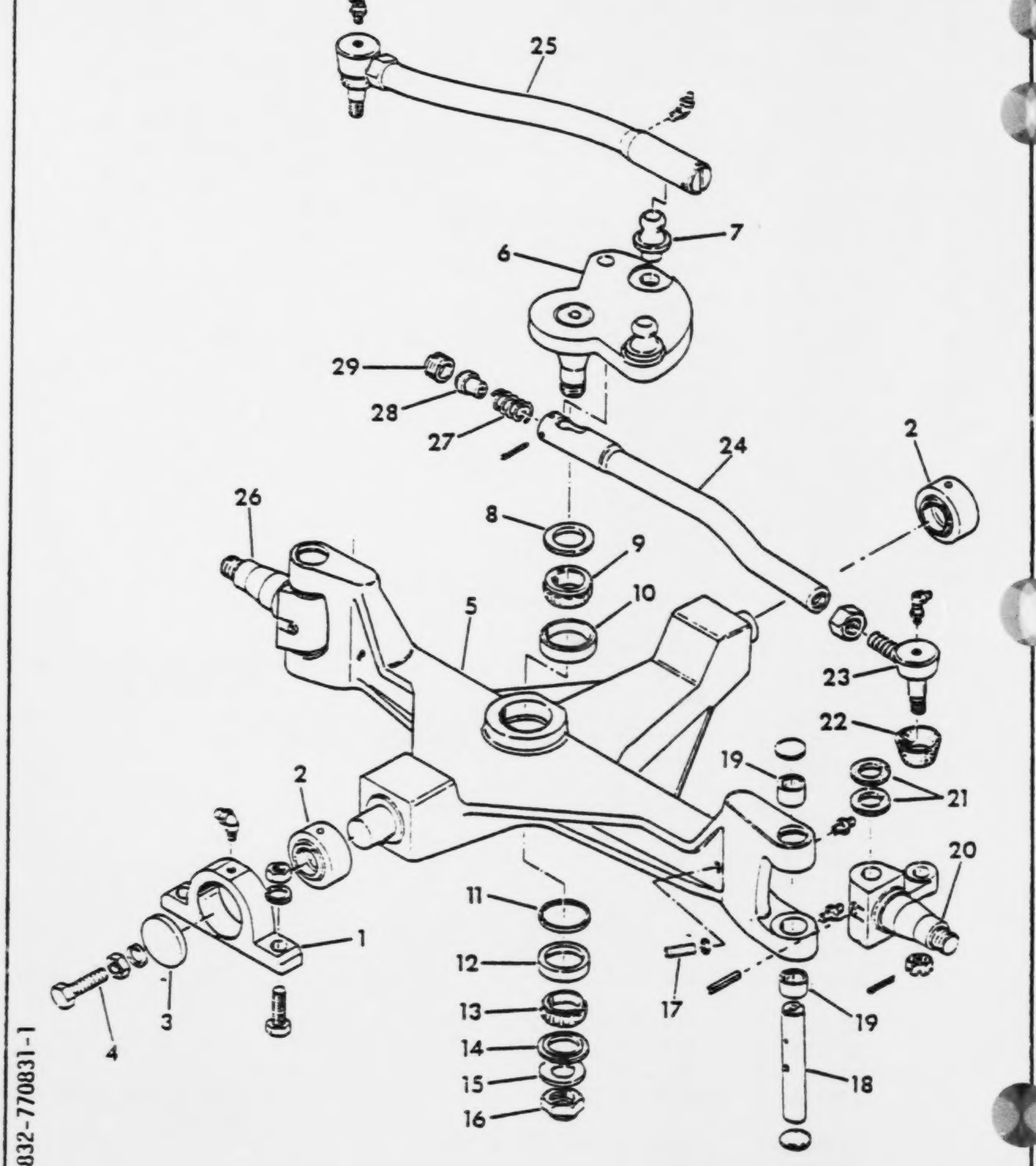

770832-770831-1

STEER AXLE

ITEM	PART NO.	DESCRIPTION	QTY.	
-	4831978-4	AXLE ASSY-STEER	1	INCL ITEMS 5 THRU 29
1	4856621-8	HOUSING	2	
	0929531-2	CAPSCREW-.50"-20 X 3.00"	4	
	0916966-5	LOCKWASHER-.50"	4	
	0919423-4	NUT-.50"-20	4	
	0922212-6	FITTING-90°-13" PT	1	
	0923014-5	FITTING-LUBE-45°-.13" PT	1	
2	4808387-7	BUSHING	2	
3	4823121-1	SPACER	1	
4	0923464-2	CAPSCREW-.75"-10 X 3.00"	1	
	0919332-7	LOCKWASHER-.75"	1	
	0922037-7	NUT-.75"-10	1	
5	4830998-3	AXLE ASSY	1	
	0922887-5	FITTING-LUBE-STR-.13"	1	
6	4831977-6	ARM ASSY-PIVOT	1	INCL ITEM 7
7	4807683-0	STUD-BALL	3	
8	0927933-2	SEAL-UPPER	1	
9	0927435-8	CONE-UPPER	1	
10	0927434-1	CUP-UPPER	1	
11	4811824-4	RING-SNAP	1	
12	0927436-6	CUP-LOWER	1	
13	0927437-4	CONE-LOWER	1	
14	0927932-4	SEAL-LOWER	1	
15	0931314-9	WASHER-.88" X 1.75"	1	
16	4808392-7	NUT	1	
17	0919350-9	SETSCREW-OVAL PT-HEX SOC -.50"-13 X 2.00"	2	
	0913744-9	NUT-JAM-.50"-13	2	
18	4909730-6	PIN KIT-KINC	2	INCL PLUGS-PINS AND ITEMS 19 & 21
	0910007-4	PLUG-EXPANSION-1.38"	4	
	0922887-5	FITTING-LUBE-STR-1.25" DRIVE	4	
19	4253263-0	BEARING-NEEDLE	4	
20	4808396-8	SPINDLE-RH	1	
	0926243-7	PIN-SPIROL-.25" X 2.25"	1	
21	4844078-8	WASHER-THRUST	4	
22	4992397-2	COVER	2	
23	4992396-4	SOCKET-BALL	2	INCL ITEM 22
	0917361-8	NUT- SLOTTED-.56"-18	2	
	0929586-6	PIN-COTTER-.09" X 1.25"	2	
	0915275-2	FITTING-LUBE- 65°-.25" PT	2	
24	4767763-8	ROD ASSY-TIE-RH	1	INCL ITEMS 22-23-27 28-29
	0918453-2	PIN-COTTER-.12" X 1.25"	1	
	0915538-3	FITTING-LUBE-65°-.25" PT	2	
	0910847-3	NUT-JAM-.75"-16	2	
25	4767762-0	ROD ASSY-TIE-LH	1	INCL ITEMS 22-23-27 28-29
	0918453-2	PIN-COTTER-.12" X 1.25"	1	
26	4808397-6	SPINDLE-LH	1	
	0926243-7	PIN-SPIROL-.25" X 2.25"	1	

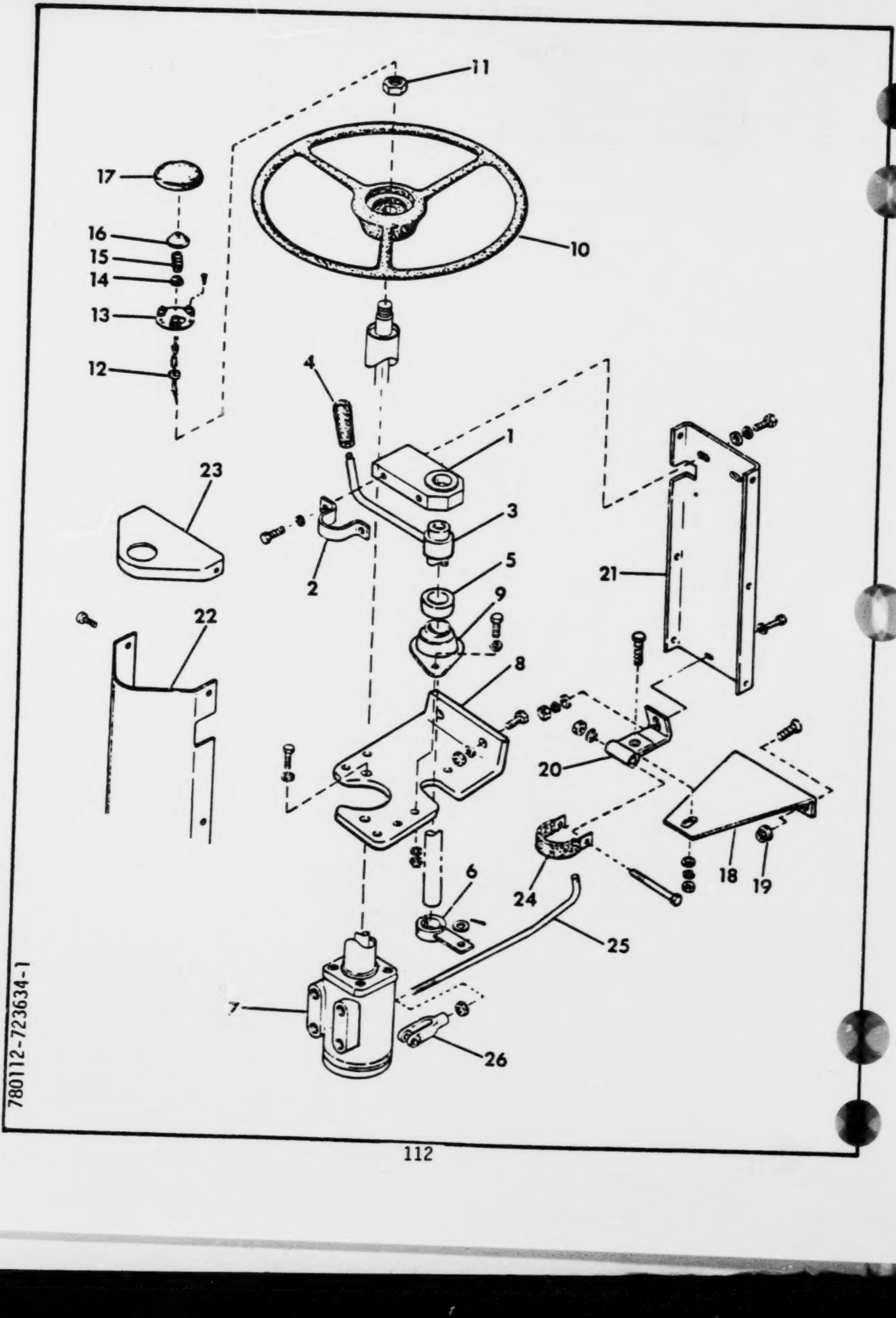
770832-770831-1

CONTINUED


770832-770831-1

STEER AXLE (CONTINUED)

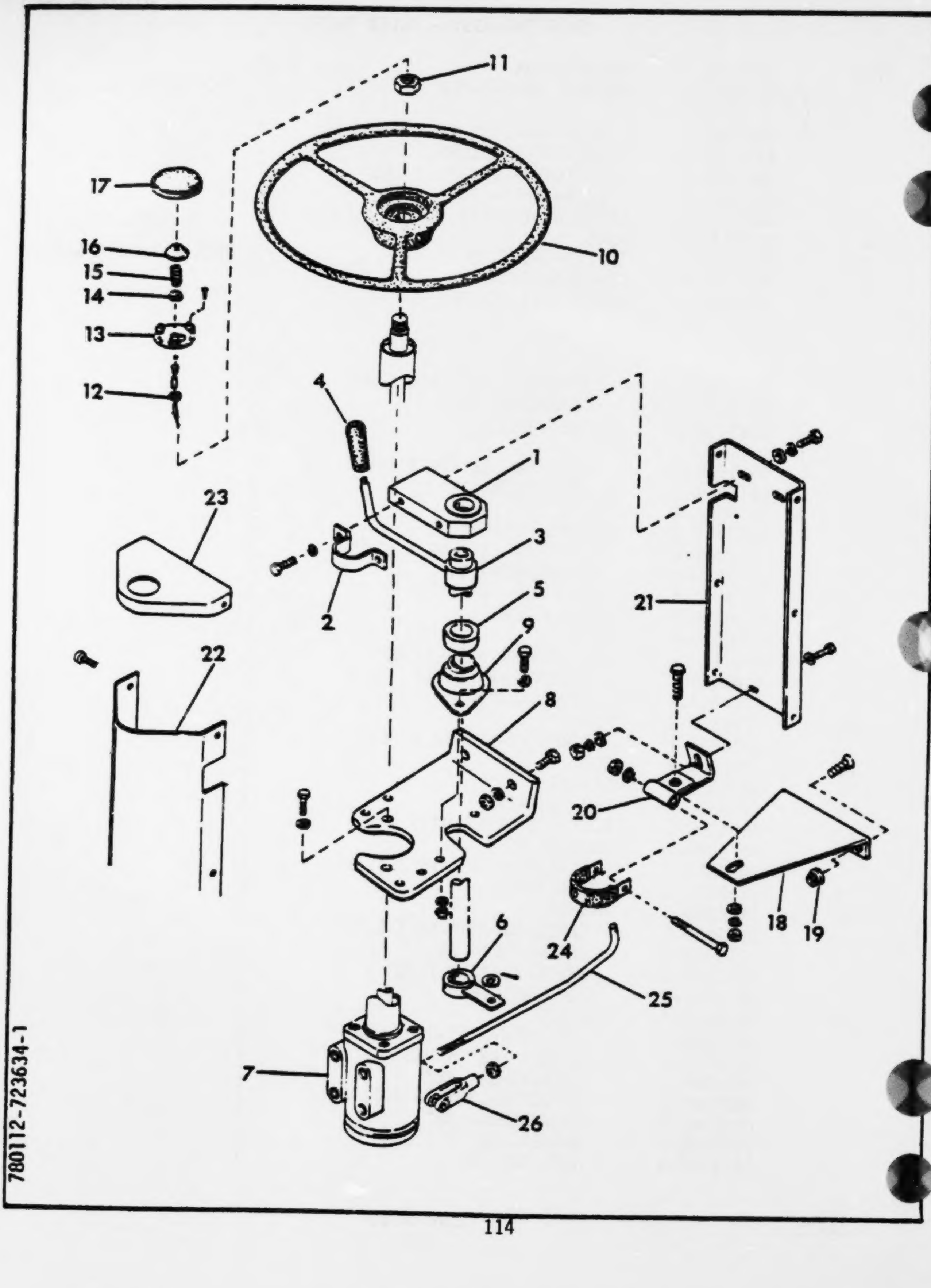
ITEM	PART NO.	DESCRIPTION	QTY.
27	4781446-2	SPRING	2
28	4769247-0	SEAT-BALL	2
29	4769248-8	PLUG-ADJUSTING	2


780112-723634-1

SHIFTING ASSY - POWER SHIFT

ITEM	PART NO.	DESCRIPTION	QTY	
1	4888561-1	BRACKET ASSY-UPPER	1	INCL BUSH
	4847462-3	BUSHING-1.12" ID X 1.38" OD	1	
2	4832723-3	CLAMP-STEER COLUMN	1	
	0921959-3	CAPSCREW-.25"-20 X .63"	2	
	0916964-0	LOCKWASHER-.25"	2	
3	4861170-1	LEVER ASSY-OUTER	1	
4	0233770-7	KNOB	1	
5	4840790-2	COLLAR-SHIFTING	1	INCL CLAMPING SCREW
6	4851222-2	LEVER-SHIFTING	1	
7	4886865-7	STEER UNIT-POWER	1	SEE PAGE 117
	0921969-2	CAPSCREW-.38"-16 X 1.50"	2	
	0916965-7	LOCKWASHER-.38"	2	
8	4887339-2	BRACKET-STEER	1	
	0921969-2	CAPSCREW-.38"-16 X 1.50"	2	
	0916965-7	LOCKWASHER-.38"	2	
	0916950-9	NUT-.38"-16	2	
9	4832715-9	BEARING-FLANGE	1	
	0923325-5	CAPSCREW-.31"-18 X .88"	2	
	0917356-8	LOCKWASHER-.31"	2	
	0917372-5	NUT-.31"-18	2	
10	4709816-5	WHEEL-STEERING	1	
11	4785070-6	NUT	1	
12	---------	WIRE-BLACK-16 GA-38.00"	1	
	4408655-1	TERMINAL-RING-#10	1	
	4724667-3	TERMINAL-TIP	1	
13	4786323-8	PLATE	1	
	0920102-1	SCREW-RD-#10-32 X .63"	3	
14	4786324-6	CUP	1	
15	4786325-3	SPRING	1	
16	4786326-1	CAP-CONTACT	1	
17	4884062-3	BUTTON & COVER UNIT	1	
18	4877004-4	SUPPORT ASSY	1	
	0929557-7	CAPSCREW-.38"-16 X 1.75"	2	
19	4255041-8	NUT-FLANGED	2	
20	4876955-8	ANCHOR	1	
	0921967-6	CAPSCREW-.38"-16 X 1.12"	1	
	0916965-7	LOCKWASHER-.38"	1	
	0917378-2	WASHER-.44" X 1.00"	1	
	0916950-9	NUT-.38"-16	1	
21	4856627-7	BRACKET	1	
	0921959-3	CAPSCREW-.25"-20 X .63"	2	
	0918264-3	WASHER-.28" X .63"	2	
	0916964-0	LOCKWASHER-.25"	2	
	0921967-6	CAPSCREW-.38"-16 X 1.12"	1	
	0916965-7	LOCKWASHER-.38"	1	
	0917378-2	WASHER-.44" X 1.00"	1	
	0916950-9	NUT-.38"-16	1	

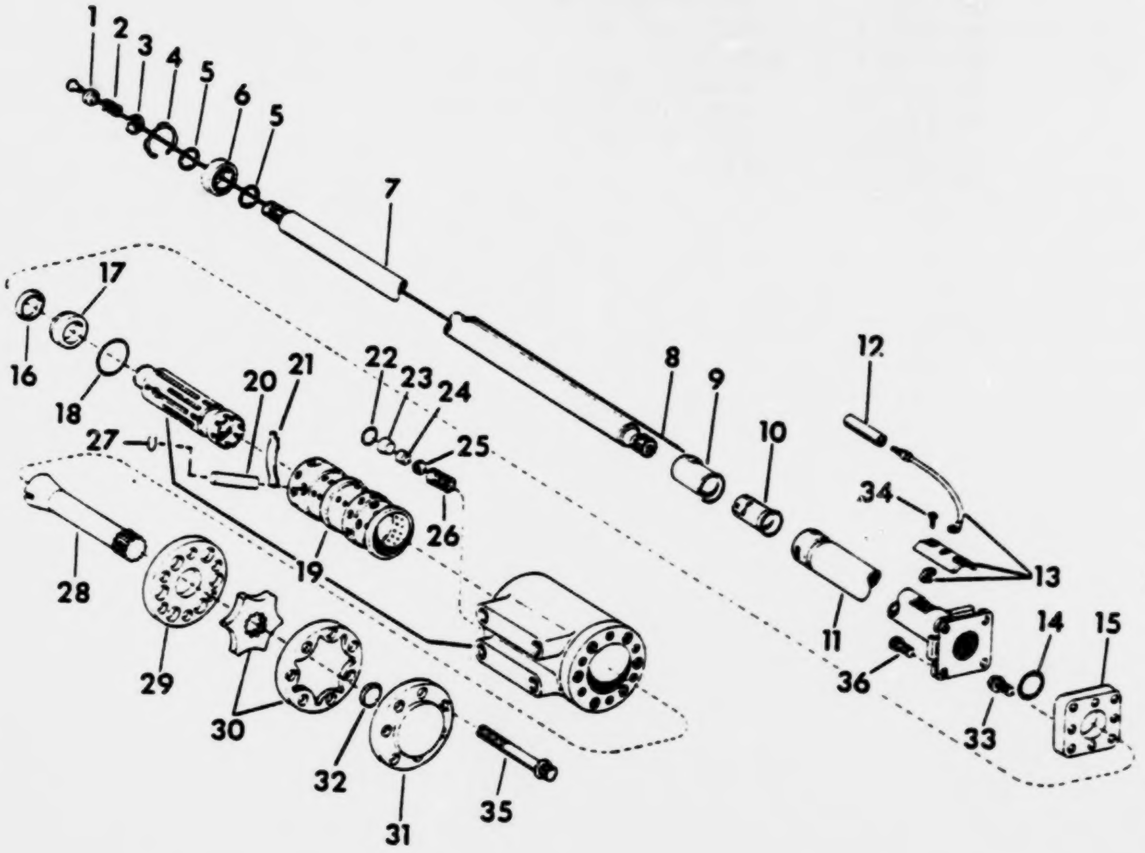
CONTINUED



780112-723634-1

SHIFTING ASSY - POWER SHIFT (CONTINUED)

ITEM	PART NO.	DESCRIPTION	QTY
22	4857348-9	SHROUD-REAR	1
	0927426-7	SCREW-#10-24 X.50"	6
23	4856625-1	COVER-SHROUD	1
24	4765753-1	CLIP	1
	0922130-0	CAPSCREW-.38"-16 X 2.25"	1
	0916965-7	LOCKWASHER-.38"	1
	0916950-9	NUT-.38"-16	1
25	4832732-4	ROD-SHIFT	1
	0919326-9	WASHER-.34" X .75"	1
	0919313-7	PIN-COTTER-.09" X .50"	1
	0920438-9	NUT-.31"-24	1
26	4847561-0	YOKE	1



56076

STEER UNIT-4886865-7

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4914197-1	COLUMN ASSY-STEERING	1	INCL ITEMS 2 THRU 5
2	4914151-8	CAP-OUTER TUBE	1	
3	4995383-9	BRUSH ASSY	1	
4	4995382-1	SCREW	2	
5	4995380-5	CONNECTOR	1	
6	0923335-4	CAPSCREW-12 PT-.38"-16 X .75"	2	
-	4914153-4	CONTROL UNIT-STEERING	1	INCL ITEMS 7 THRU 29
7	4995372-2	*SEAL	1	
8	4912468-8	RING-SNAP	1	
9	4912469-6	BUSHING-SEAL GLAND	1	
10	4912470-4	*SEAL	1	
11	0239191-0	*SEAL-QUAD RING	1	
12	4914167-4	#RACE-THRUST	2	
13	4912473-8	#BEARING-NEEDLE THRUST	1	
14	4914160-9	CONTROL PARTS	1	INCL ITEMS 15 & 16
15	4994900-1	PIN-CENTERING	1	
16	4994901-0	SPRING-CENTERING	6	
17	4912968-7	*O-RING	1	
18	4914166-6	SETSCREW	1	
19	4914163-3	SEAT-CHECK BALL	1	
20	4914162-5	BALL-CHECK	1	
21	4914161-7	RETAINER-CHECK BALL	1	
22	0923559-9	*O-RING-#-011	1	
23	1132770-7	DRIVE	1	
24	4912459-5	*O-RING	3	
25	4914158-3	PLATE-SPACER	1	
26	4914156-7	GEROTOR SET	1	
27	4913435-8	SPACER	1	
28	4914155-9	CAP	1	
29	1164202-2	CAPSCREW	7	

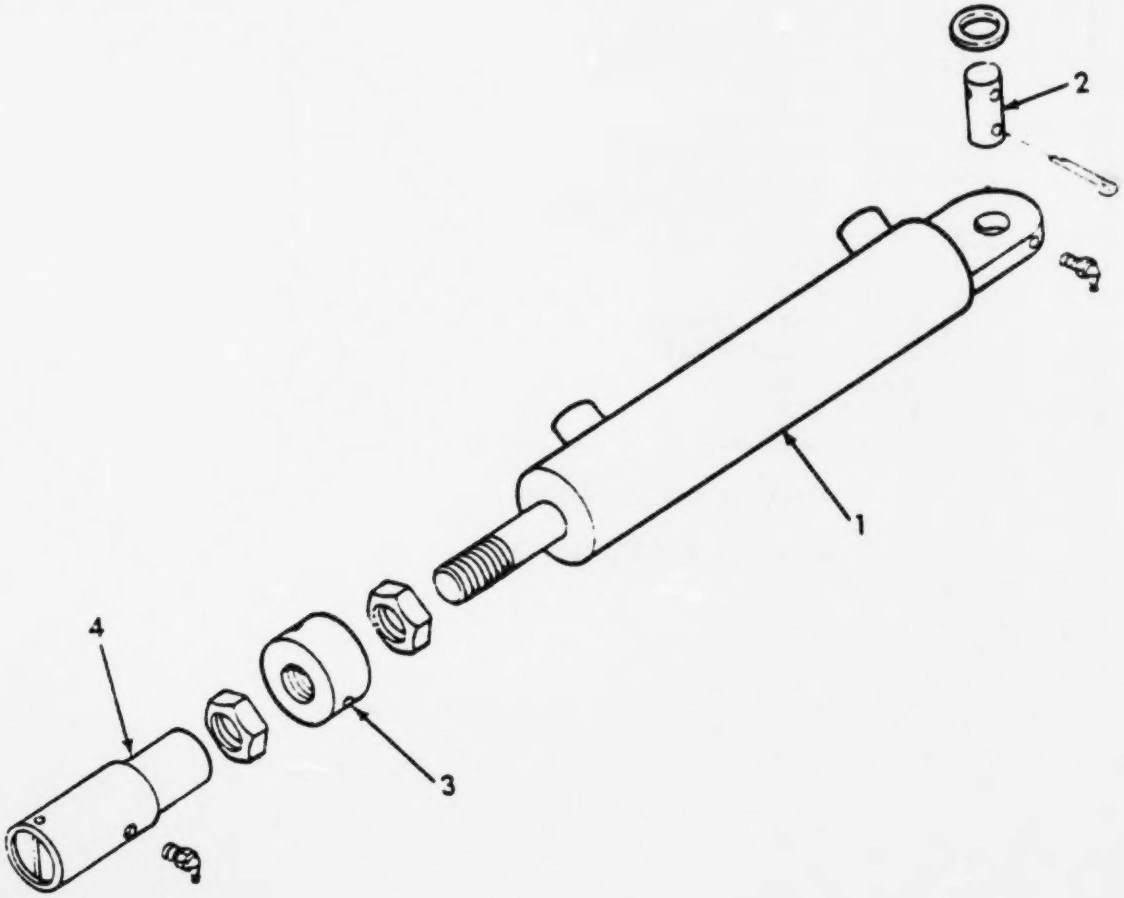
*INCL IN KIT 4914283-9

#INCL IN KIT 4912471-2

780407-780228-2

POWER STEERING LINKAGE

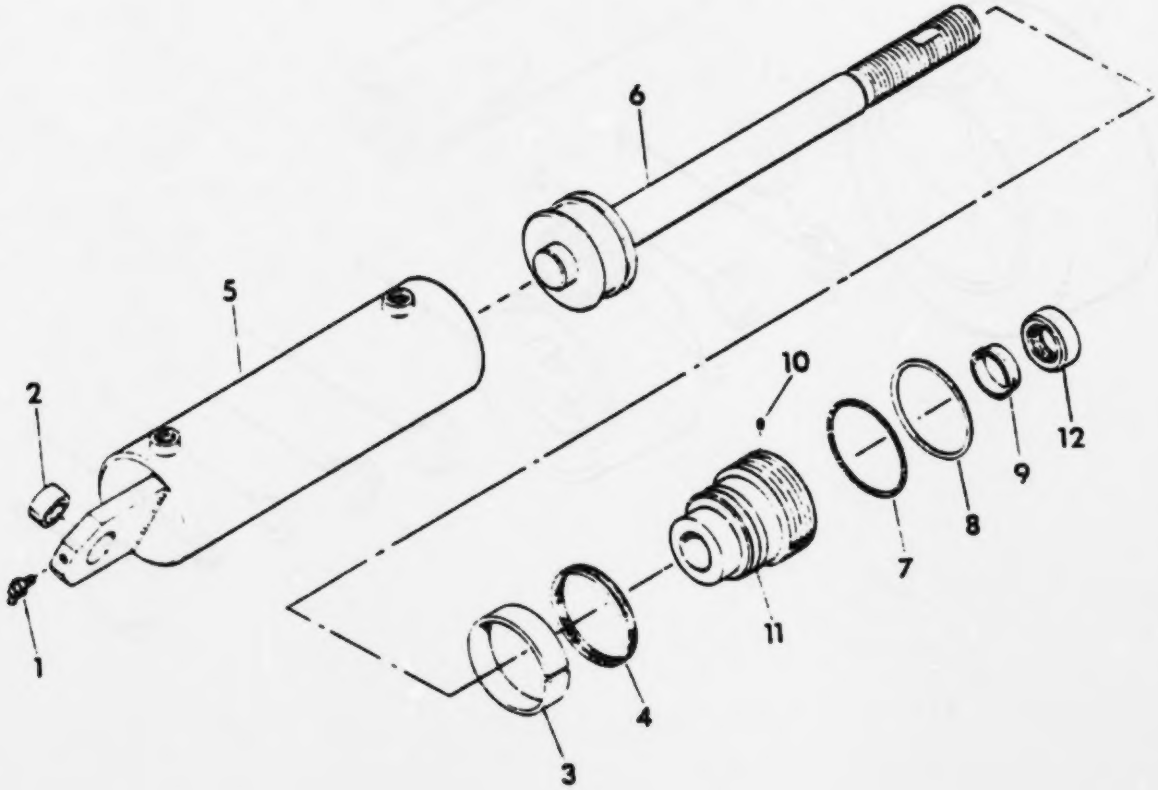
ITEM	PART NO.	DESCRIPTION	QTY.	
1	4864447-0	CYLINDER ASSY	1	SEE PAGE 119
	0918187-6	FITTING LUBE-45°-.25" PT	1	
2	4812705-4	PIN	1	
	0919390-5	WASHER-.78" X 1.25"	2	
	0920117-9	PIN-COTTER-.16" X 1.50"	2	
3	4874858-6	SPACER-ADJ	1	
	0920439-7	NUT-JAM-.88"-14	1	
4	4820980-3	YOKE ASSY	1	SEE PAGE 121
	0918187-6	FITTING-LUBE-45°-.25" PT	1	
	0920439-7	NUT-JAM-.88"-14	1	



POWER STEER CYLINDER-4864447-0

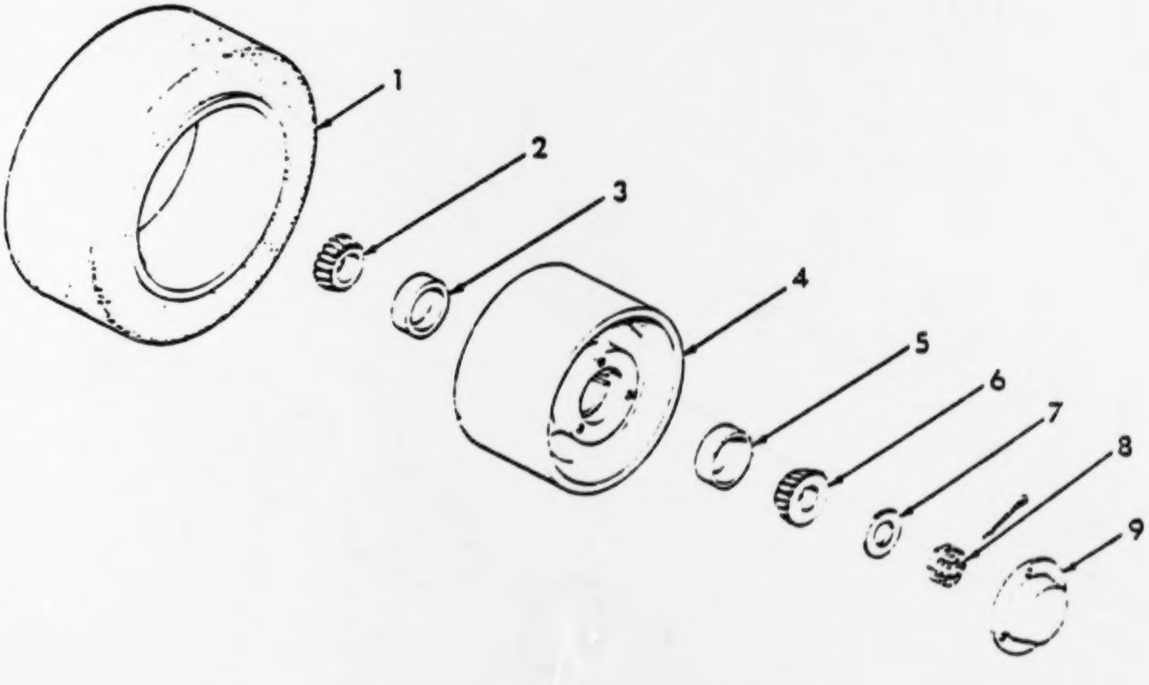
ITEM	PART NO.	DESCRIPTION	QTY.
1	0930679-6	FITTING-LUBE-30°-.25"-28	1
2	4829439-1	BEARING	1
3	4863192-3	*BEARING	1
4	4863193-1	*T-RING	1
5	4867521-9	TUBE ASSY	1
6	4867522-7	PLUNGER ASSY	1
7	0923572-2	*O-RING-#-133	1
8	0931433-7	*RING-BACKUP	1
9	4875492-3	*PACKING	1
10	4816749-8	*PELLET-NYLON	2
11	4857708-4	NUT-GLAND	1
12	4863194-9	*WIPER	1

*INCL IN SEAL KIT 4910088-6



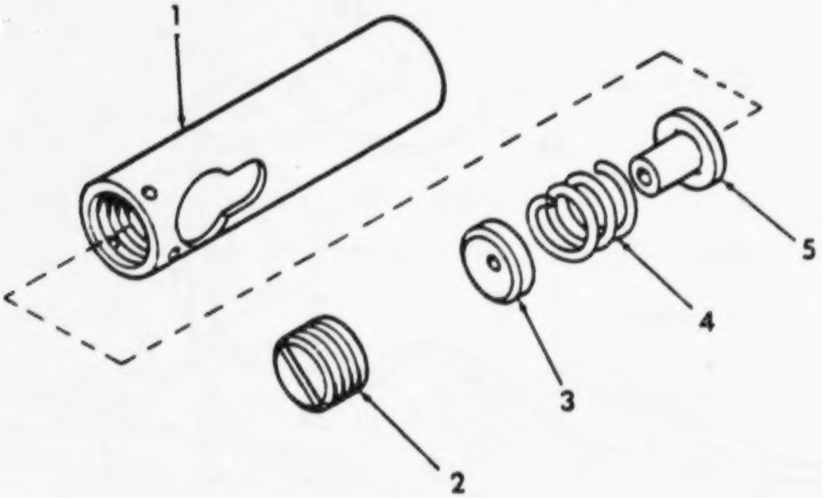
STEER WHEEL

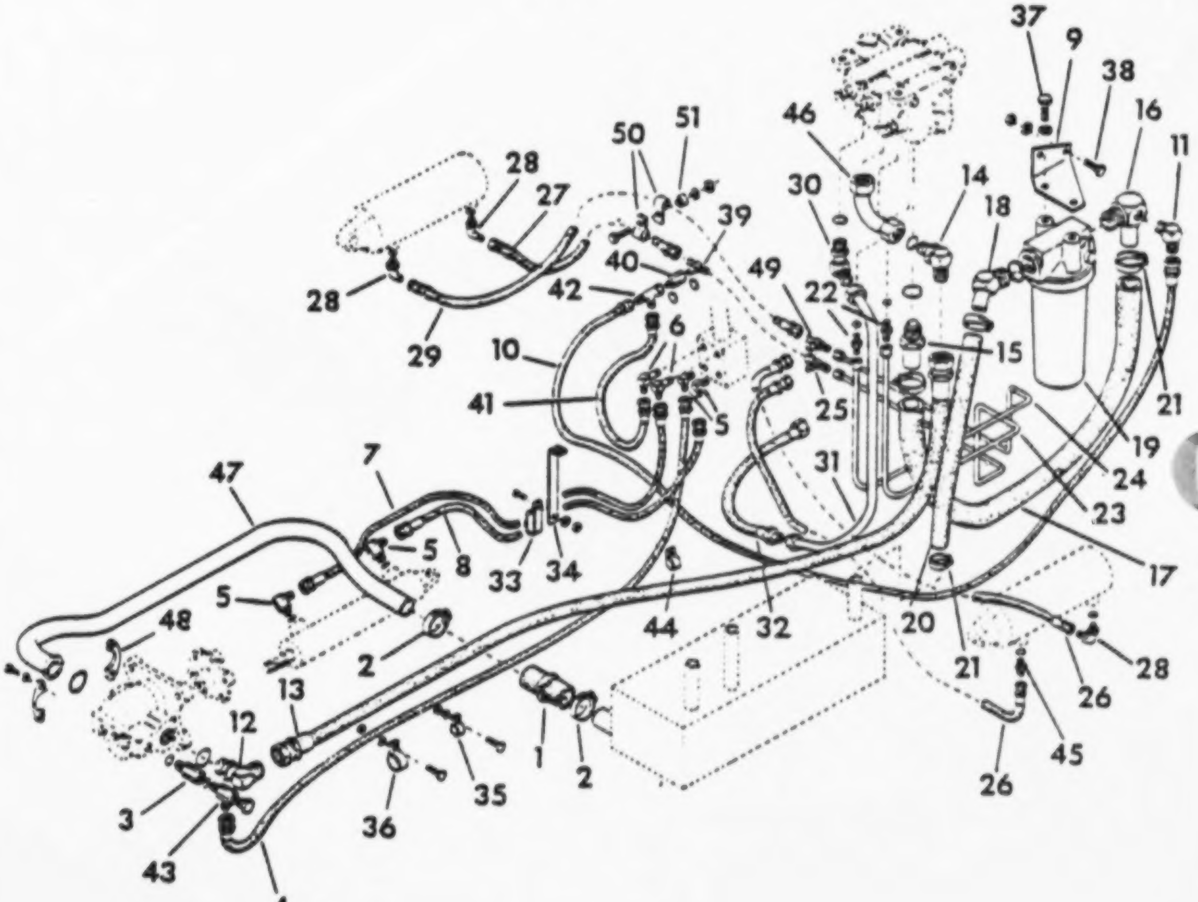
ITEM	PART NO.	DESCRIPTION	QTY.	
1	4713023-2	TIRE-16.25" X 5" X 11.25"	2	CUSHION
2	0926702-2	CONE-INNER	2	
3	4254318-1	CUP-INNER	2	
4	4758727-4	WHEEL-STEER	2	
5	4254704-2	CUP-OUTER	2	
6	4254703-4	CONE-OUTER	2	
7	0929369-7	WASHER-1.16" x 2.00"	2	
8	0925719-7	NUT-JAM-SLOTTED-1.12"-12	2	
	0922002-1	PIN-COTTER .13" x 2.00"	2	
9	4706891-1	CAP-HUB	2	
	0921965-0	CAPSCREW-.38"-16 X .75"	6	
	0916803-0	LOCKWASHER-INT-.38"	6	



YOKE ASSY-4820980-3

ITEM	PART NO.	DESCRIPTION	QTY.	
1	---------	SOCKET	1	ORDER ASSY
2	4769248-8	PLUG-ADJUSTING	1	
3	4981815-6	SEAT-BALL	1	
4	4781446-2	SPRING	1	
5	---------	PLUG	1	ORDER ASSY



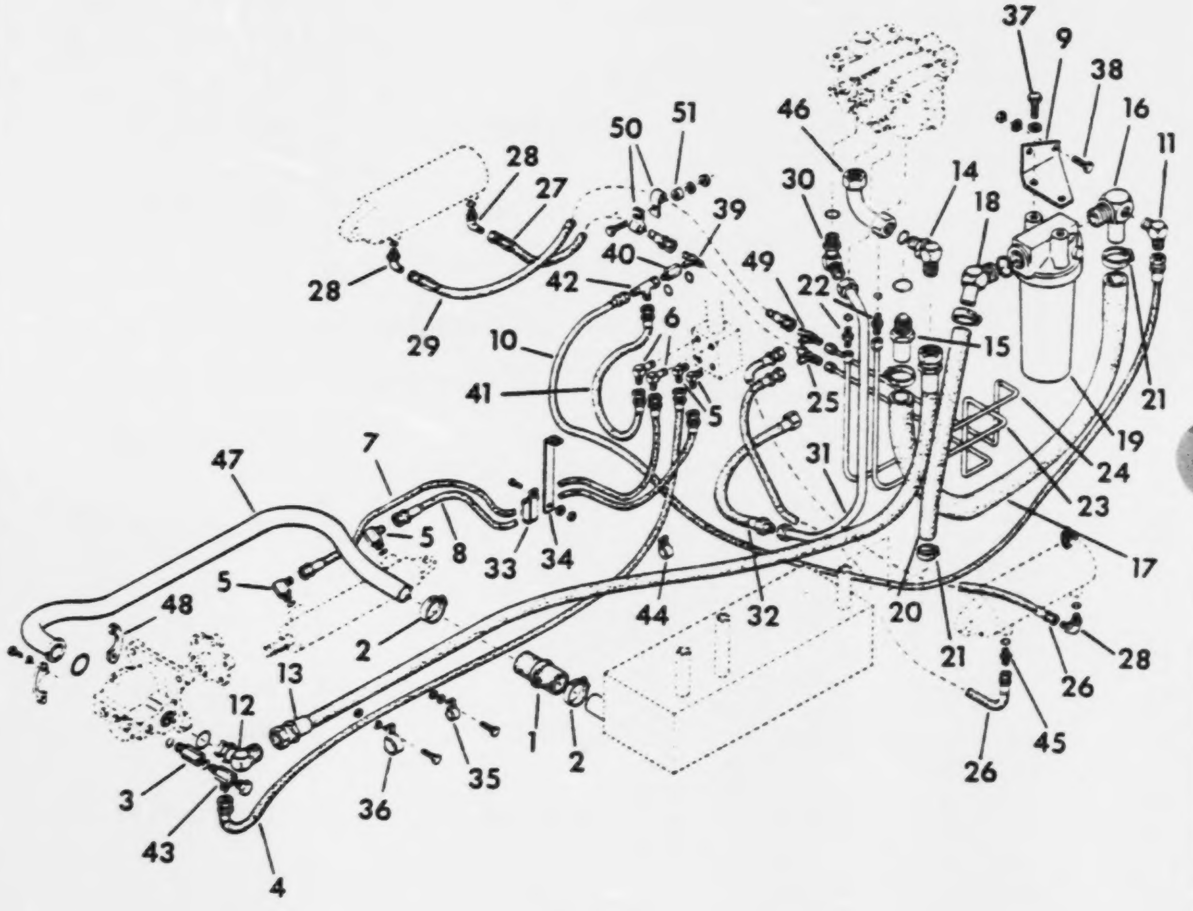

37
9
38
16
11
46
51
50
28
27
30
14
18
39
40
49
22
42
15
28
6
29
10
25
41
5
21
19
31
24
23
47
7
5
8
33
34
17
5
48
44
32
20
21
28
2
26
13
12
1
2
35
45
26
3
36
43
4

780116-71319-2

HYDRAULIC SYSTEM

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4877822-9	HOSE-SUCTION-6.00"	1	
2	0921912-2	CLAMP-HOSE-SAE SIZE #32	2	
3	4839229-4	VALVE-CHECK	1	
	0921885-0	O-RING-#-906	1	
4	4856612-9	HOSE ASSY-70.00"	1	
5	0922523-6	ELBOW-SHORT-.56"-18-STR THD	4	INCL O-RING
	0921885-0	O-RING-#-906	4	
6	0925295-8	ELBOW-LONG-.56"-18-STR THD	2	INCL O-RING
	0921885-0	O-RING-#-906	2	
7	4861541-3	HOSE ASSY-40.00"	1	
8	4861540-5	HOSE ASSY-30.00"	1	
9	4814246-7	BRACKET-FILTER	1	
10	4826246-3	HOSE ASSY-45.00"	1	
11	0919136-2	ELBOW-.38" PT .56"-18	1	
12	0921203-6	ELBOW-SHORT-1.06"-STR THD	1	INCL O-RING
	0921206-9	O-RING-#-912	1	
13	4846114-9	HOSE ASSY-61.00"	1	
14	0921203-6	ELBOW-90°-1.06"-12-STR THD	1	INCL O-RING
	0921206-9	O-RING-#-912	1	
15	4845319-5	ADAPTOR-1.06"-12 STR THD	1	
	0921206-9	O-RING-#-912	1	
16	4857172-3	ELBOW-BARB STEM-90°-1.31" STR THD	1	
17	4808348-9	HOSE-1.00" ID X 32.00"	1	
18	0929191-5	ELBOW-BARB STEM-45°-1.31" STR THD	1	INCL O-RING
	0921214-3	O-RING-#-916	1	
19	4861809-4	FILTER-OIL	1	SEE PAGE 133
20	4805651-9	HOSE-1.00" ID X 20.00"	1	
21	0922660-6	CLAMP-HOSE-SAE #24	4	
22	0923163-0	CONNECTOR-.44" STR THD	2	INCL O-RING
	0921883-5	O-RING-#-904	2	
23	4845598-4	TUBE-VALVE TO LOWER TEE	1	
24	4845597-6	TUBE-VALVE TO UPPER TEE	1	
25	0926975-4	TEE-.44"-20 STR THD	1	
26	4826244-8	HOSE ASSY-11.50"	2	
27	4827755-2	HOSE ASSY-20.00"	1	
28	0922571-5	ELBOW-90°-.44"-20 STR THD	3	INCL O-RING
	0921883-5	O-RING-#-904	3	
29	4832052-7	HOSE ASSY-16.00"	1	
30	0922974-1	ELBOW-45°-.88"-14 STR THD	1	INCL O-RING
	0921205-1	O-RING-#-910	1	
31	4843536-6	TUBE-LIFT	1	
32	4822613-8	HOSE ASSY-LIFT-28.00"	1	
33	4255744-7	CLAMP	1	
	0921210-1	CAPSCREW-.38"-16 X 1.00"	1	
	0916965-7	LOCKWASHER-.38"	1	
	0916950-9	NUT-.38"-16	1	
34	4824223-4	BRACKET-CLAMP	1	
35	4774455-2	CLAMP	1	AT OIL PAN
	0921333-1	CAPSCREW-.31"-18 X 1.00"	2	
	0915815-5	WASHER-FLAT-.38" X .75"	4	
	0928046-2	CLAMP -.75"	1	

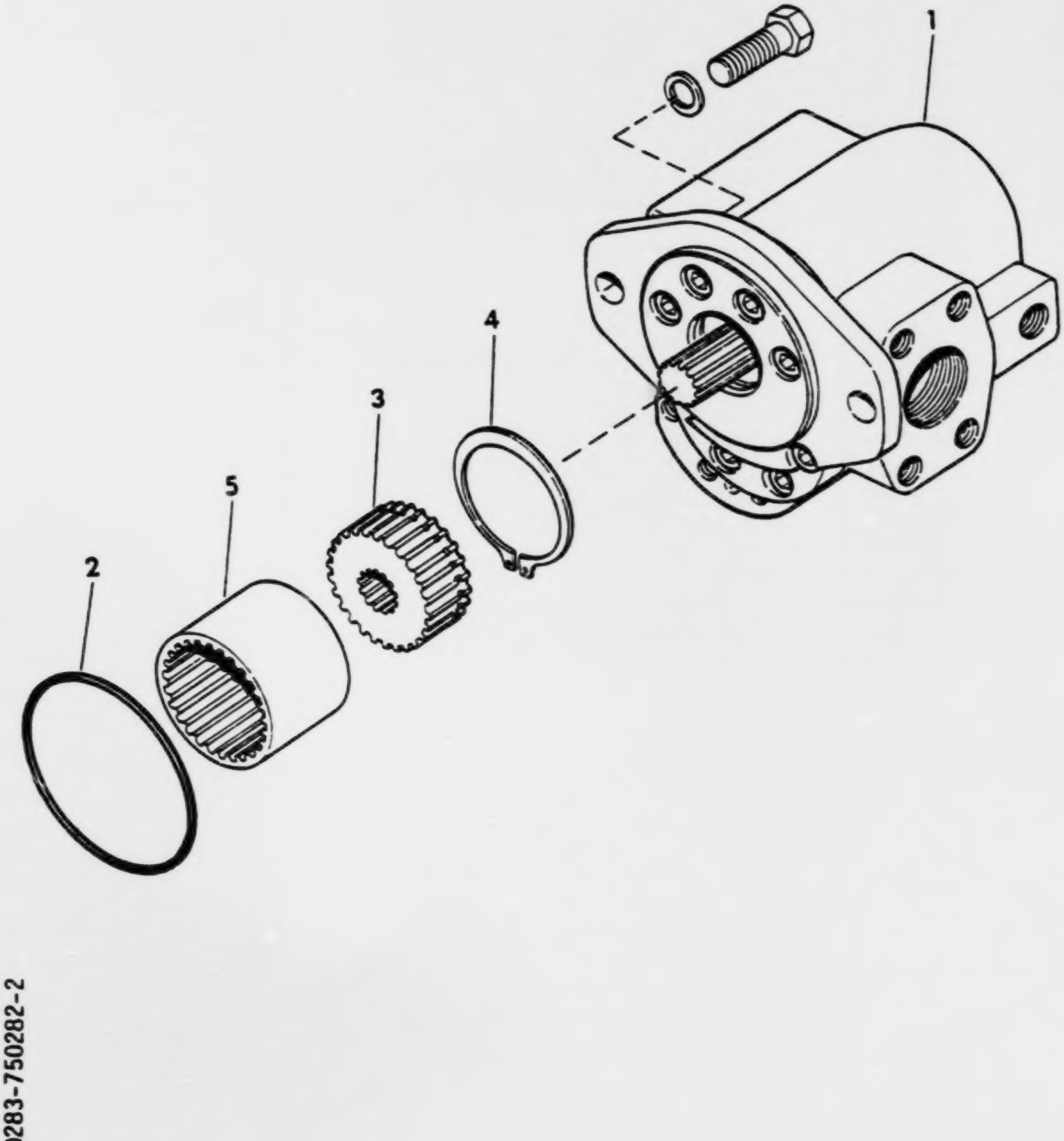
CONTINUED


37
9
38
16
11
46
51
50
28
27
30
14
18
39
40
49
22
28
42
6
29
10
15
25
21
41
5
19
24
47
7
31
23
5
8
33
34
17
5
48
44
32
20
2
21
28
26
13
12
1
2
45
35
3
36
26
43
4

780116-71319-2

HYDRAULIC SYSTEM (CONTINUED)

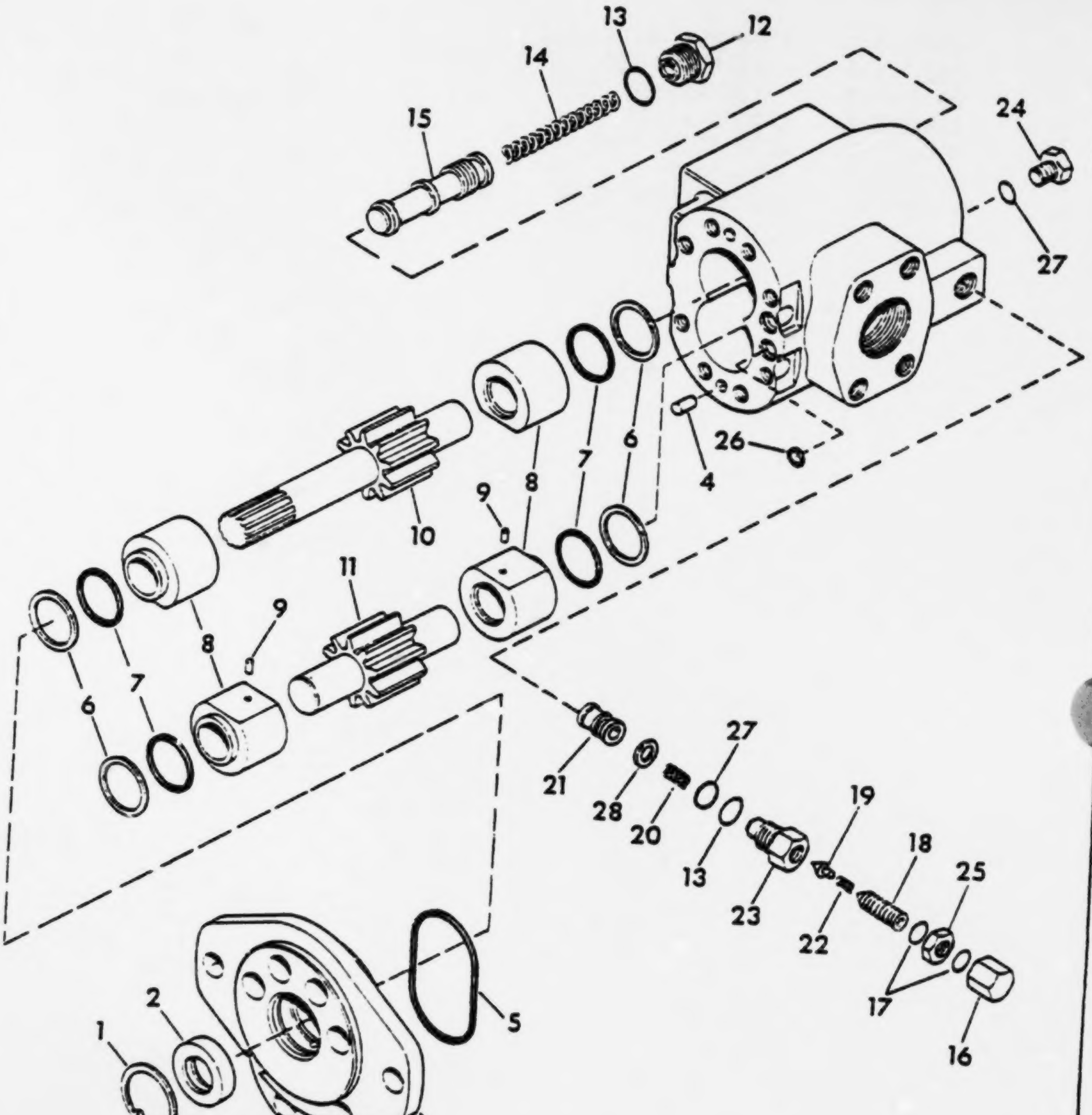
ITEM	PART NO.	DESCRIPTION	QTY.	
36	0928010-8	CLAMP-1.25" ID	1	
	0921333-1	CAPSCREW-.31"-18 X 1.00"	1	
	0915815-5	WASHER-FLAT-.38" X 1.00"	2	
37	0923114-3	CAPSCREW-.50"-12 X 1.00"	2	
	0916966-5	LOCKWASHER-.50"	2	
38	0921977-5	CAPSCREW-.31"-18 X 1.25"	2	
	0916356-8	LOCKWASHER-.38"	2	
	0917372-5	NUT-.38"-18	2	
39	0931193-7	TEE-.25" TUBE-.56"-18 STR THD	1	INCL O-RING
	0921885-0	O-RING-#-906	1	
40	4839229-4	VALVE-CHECK	1	
	0921885-0	O-RING-#-906	1	
41	4833733-1	HOSE ASSY-16.00"	1	
42	0921297-8	TEE-SWIVEL-.56"-18-STR THD	1	
43	0923894-0	TEE-.38" TUBE-.56"-18 STR THD	1	INCL O-RING
	0921885-0	O-RING-#-906	1	
	0919552-0	CAP-.38" TUBE	1	
44	0926049-8	CLAMP- .75"	1	
45	0923163-0	CONNECTOR-.44"	1	INCL O-RING
	0921883-5	O-RING-#-904	1	
46	4843535-8	TUBE ASSY-HIGH PRESS TO VALVE	1	
47	4856611-1	TUBE-SUCTION	1	
	0923578-9	O-RING-#-225	1	
48	0921118-6	FLANGE-SPLIT-1.50"	2	
	0921176-4	CAPSCREW-.50"-13 X 1.25"	4	
	0916966-5	LOCKWASHER-.50"	4	
49	0928946-3	TEE-.44"-20 STR THD	1	
50	0929597-3	CLIP-.25"	2	
51	4709114-5	SPACER	1	
	0921221-8	CAPSCREW-.31"-18 X 1.50"	1	
	0917356-8	LOCKWASHER-.31"	1	
	0917372-5	NUT-.31"-18	1	



750283-750282-2

HYDRAULIC PUMP

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4892156-3	PUMP ASSY-HYDRAULIC	1	SEE PAGE 129
	0921176-4	CAPSCREW-.50"-13 X 1.50"	2	
	0916966-5	LOCKWASHER-.50"	2	
2	4864816-6	O-RING-#-342	1	PUMP MTG
3	4909770-2	GEAR-DRIVE-PUMP	1	
4	4909763-7	RING-SNAP	1	
5	4909775-1	SLEEVE-DRIVE GEAR	1	

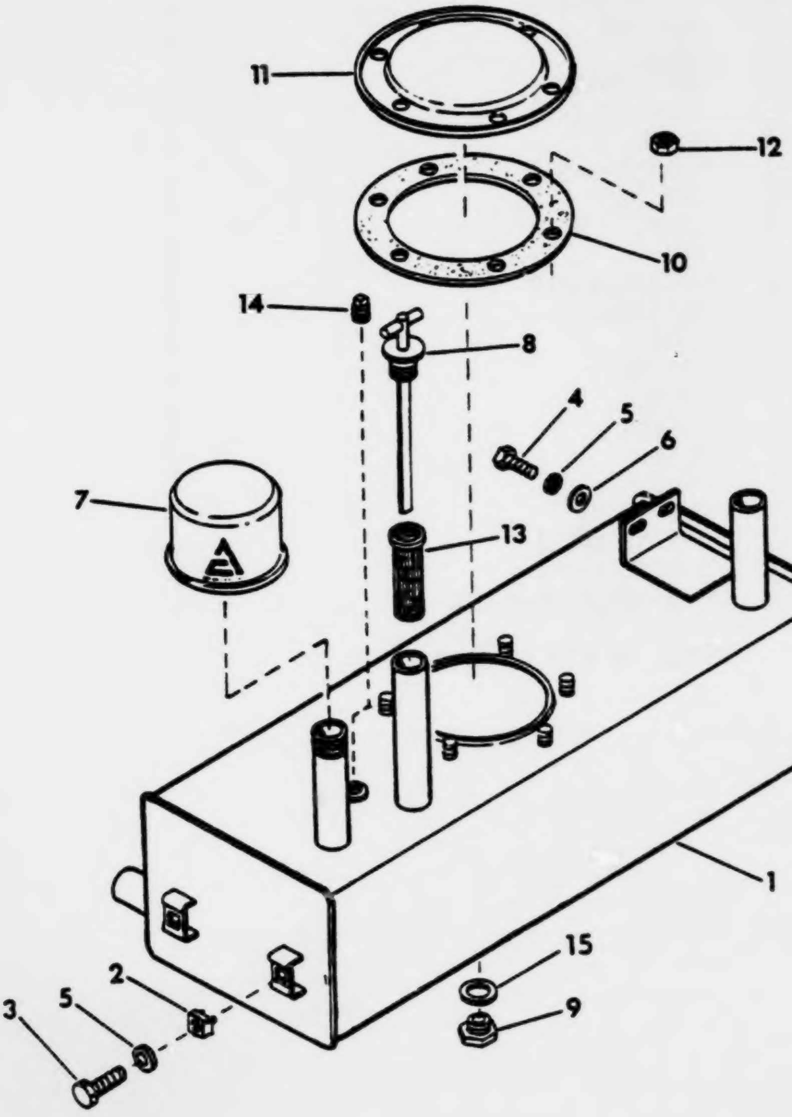

13
12
14
15
24
27
6
7
8
26
4
9
10
11
6
7
8
9
21
27
28
20
13
19
18
23
22
25
17
16
2
1
5
3

770362-750286-2

HYDRAULIC PUMP-4892156-3

ITEM	PART NO.	DESCRIPTION	QTY.
1	4254608-5	RING-SNAP	1
2	4997977-6	*SEAL-OIL	1
3	4912409-2	FLANGE	1
	0917469-9	CAPSCREW-.38"-24 X 1.00"	8
4	4993825-0	DOWEL-BODY	2
5	0933874-0	*O-RING-#-040	1
6	4999827-1	*RING-BACK-UP	4
7	0924092-0	*O-RING-#-216	4
8	4910628-9	BUSHING	4
9	4993823-6	DOWEL	2
10	4909289-3	GEAR-DRIVE	1
11	4909483-2	GEAR-IDLER	1
12	4906387-8	PLUG	1
13	0921205-1	*O-RING-#-910	2
14	4909493-1	SPRING	1
15	4905003-2	SPOOL	1
16	4912928-1	NUT	1
17	0928241-9	*O-RING-#-013	2
18	4912868-9	SETSCREW	1
19	4912934-9	CONE	1
20	4912936-4	SPRING	1
21	4912935-6	SPOOL	1
22	4912933-1	SPRING	1
23	4912930-7	PLUG	1
24	4912931-5	PLUG	1
25	4912929-9	NUT-LOCK	1
26	0924048-2	*O-RING-#-012	2
27	0923841-1	*O-RING-#-014	2
28	4912932-3	*RING-BACK-UP-#-014	1

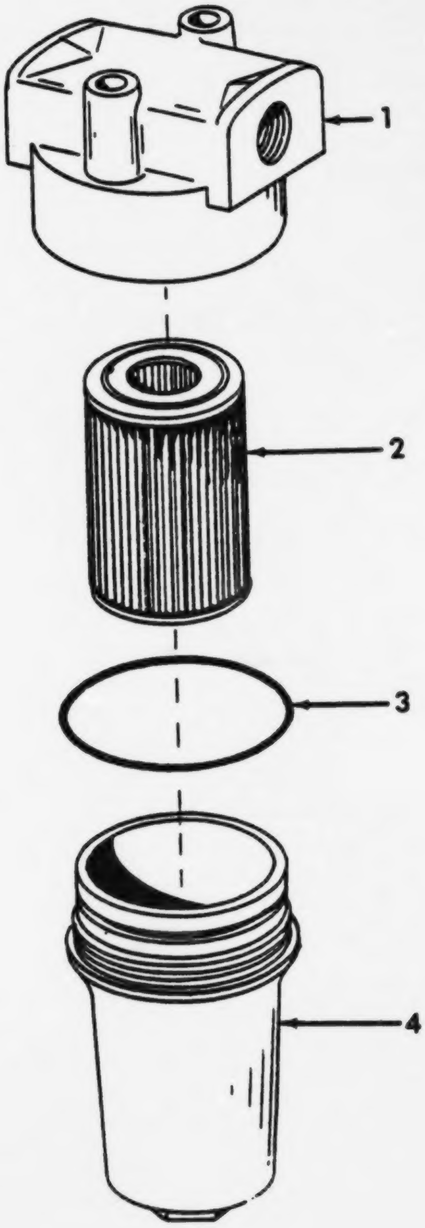
*INCL IN KIT 4912510-7


11
12
10
14
8
4
5
6
7
13
1
15
2
9
3
5

750135-710419-1

RESERVOIR

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4836253-7	RESERVOIR-HYDRAULIC OIL	1	INCL ITEMS 10-11 & 12
2	0921705-0	NUT-RETAINER-.38"-16	2	
3	0922130-0	CAPSCREW-.38"-16 X 2.25"	2	
4	0921966-8	CAPSCREW-.38"-16 X .88"	2	
5	0916965-7	LOCKWASHER-.38"	4	
6	0918266-8	WASHER-.41" X .81"	2	
7	4835378-3	FILTER-AIR	1	
8	4828803-9	DIPSTICK	1	
9	4855689-8	PLUG-DRAIN	1	
10	4823391-0	GASKET	1	
11	4907320-8	COVER	1	
12	0919441-6	NUT-LOCK-.31"-18	6	
13	4806357-2	SCREEN-FILLER	1	
14	0901653-6	PLUG-PIPE-SQ HD-.38" PT	1	
15	4845678-4	WASHER-NYLON	1	

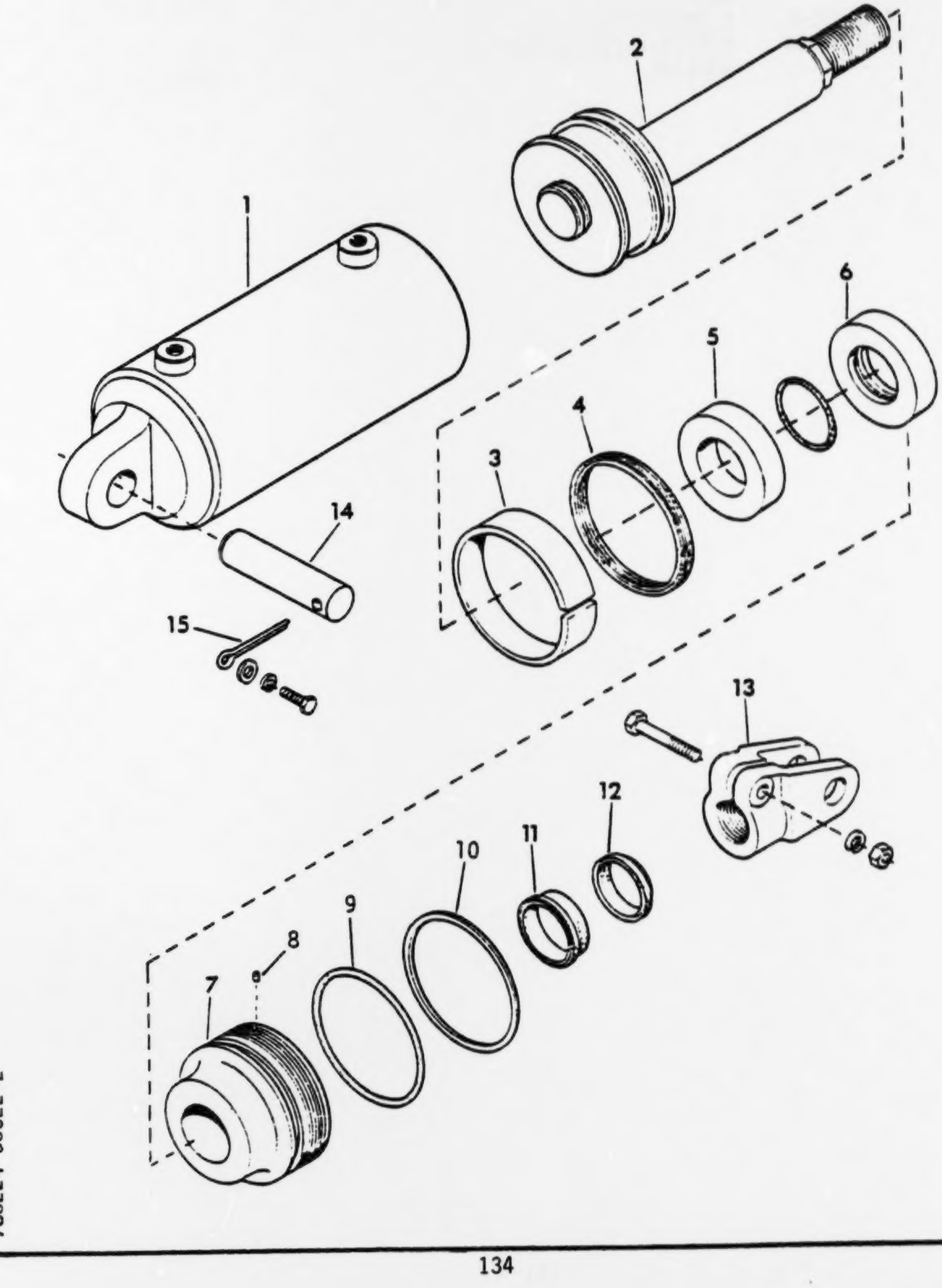


71394

HYDRAULIC FILTER
4861809-4

ITEM	PART NO.	DESCRIPTION	QTY.	
1	---------	HEAD	1	ORDER ASSY
2	4906096-5	ELEMENT-FILTER	1	
3	0923816-3	O-RING-#-236-3.234" ID	1	CLASS 1A
4	---------	HOUSING	1	ORDER ASSY

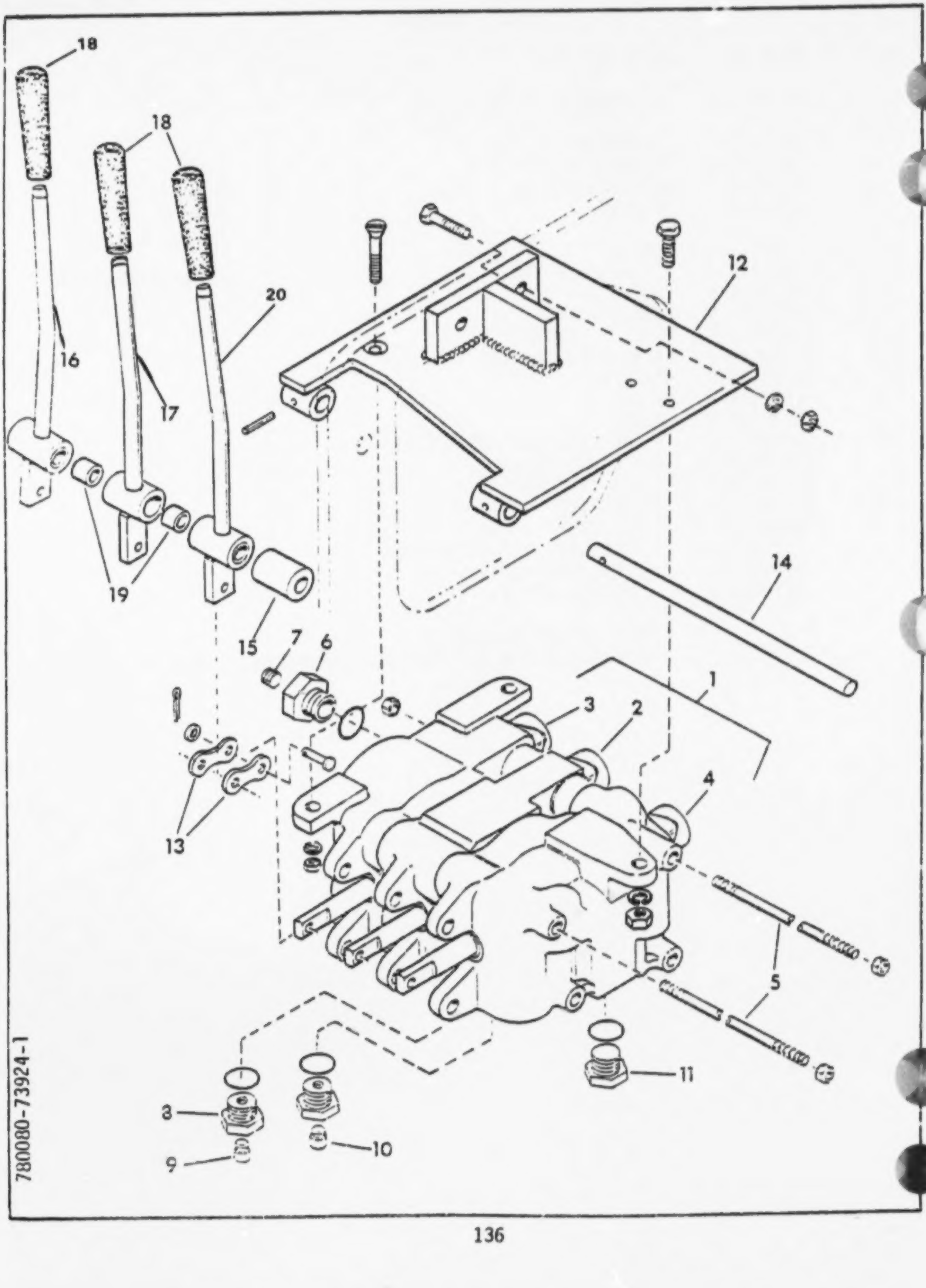
71394


780224-56522-2

TILT CYLINDER

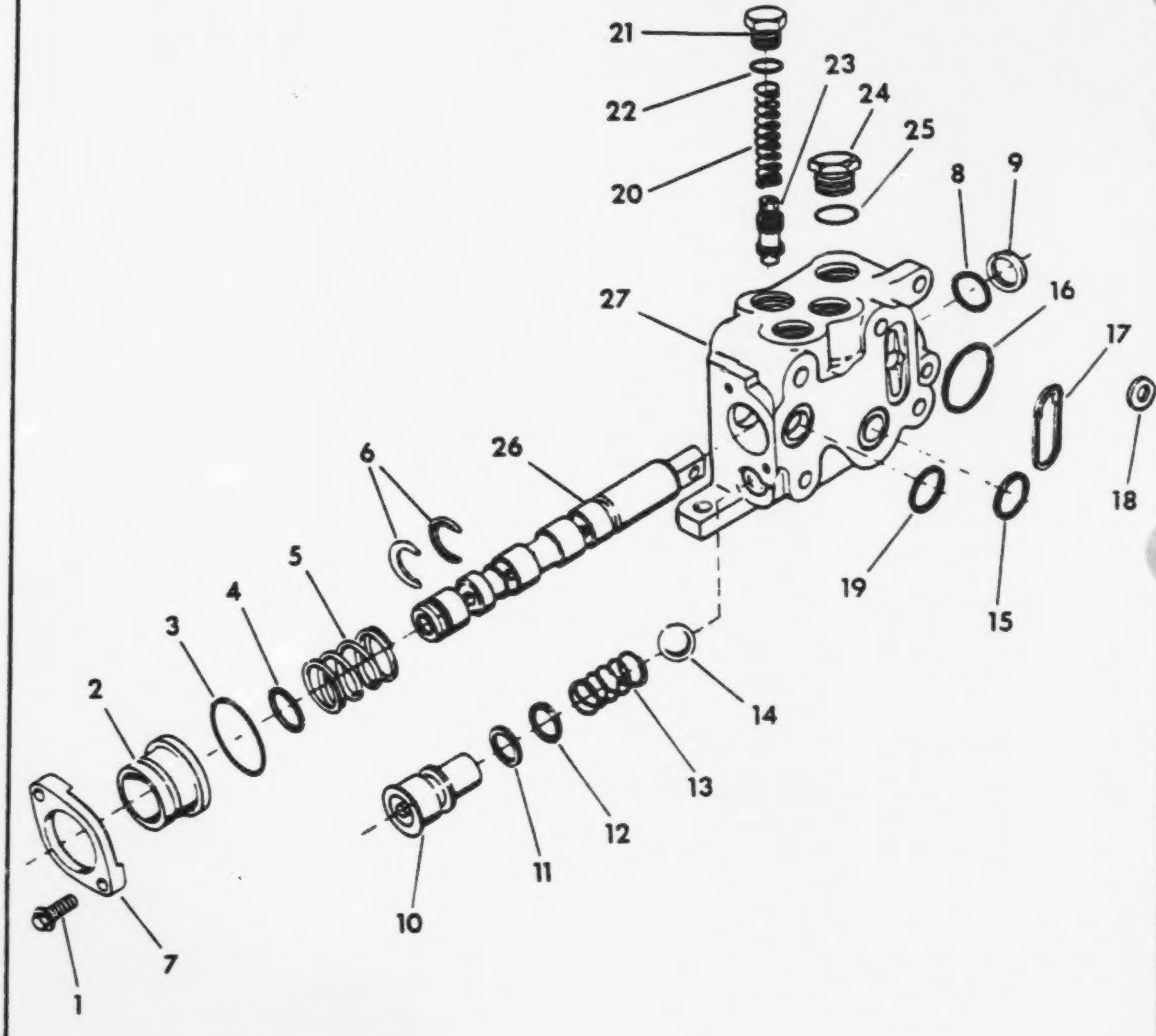
ITEM	PART NO.	DESCRIPTION	QTY.	
-	4825041-9	CYLINDER ASSY-TILT	2	
1	4809718-2	TUBE ASSY	2	
2	4829335-1	PLUNGER ASSY	2	
3	4814109-7	*BEARING	2	
4	4814133-7	*T-RING	2	
5			-	
6	4769566-3	SPACER	2	
	0923649-8	O-RING-#-218	2	USE W/ITEM 6 SPACER
7	4814134-5	NUT-GLAND	2	
8	4816749-8	*PELLET-NYLON	4	
9	0923582-1	*O-RING-BACKUP	2	
10	0926625-5	*RING-BACKUP-#-232	2	
11	4814108-9	*PACKING	2	
12	4857829-8	*WIPER	2	
13	4714616-2	YOKE	2	
	0923293-5	CAPSCREW-.50"-20 X 2.25"	2	
	0916966-5	LOCKWASHER-.50"	2	
	0919423-4	NUT-.50"-20	2	
14	4864813-3	SHAFT-PIVOT	2	
15	4859095-4	PIN-COTTER	2	
	0921210-1	CAPSCREW-.38"-16 X 1.00"	2	
	0916965-7	LOCKWASHER-.38"	2	
	0916956-6	WASHER-.41" X .75"	2	

* INCL IN KIT 4906332-4
KIT CONTAINS QUANTITIES FOR ONE CYLINDER ONLY


780080-73924-1

CONTROL VALVE

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4886785-7	VALVE ASSY	1	INCL ITEMS 2 THRU 5
	0920415-7	CAPSCREW-.38"-16 X 1.25"	1	
	0921351-3	SCREW-FH-.38"-16 X 1.25"	2	
	0916965-7	LOCKWASHER-.38"	3	
	0916950-9	NUT-.38"-16	3	
2	4913457-0	PLUNGER SECTION ASSY-TILT	1	SEE PAGE 141
3	4913456-2	PLUNGER SECTION ASSY-LIFT	1	SEE PAGE 139
4	4913458-8	PLUNGER SECTION ASSY-OUTLET	1	SEE PAGE 143
5	4908219-2	STUD	4	
	0916950-9	NUT-.38"-16	8	
6	4846665-0	PLUG	1	
	0921206-9	O-RING-#-912	1	
7	0920130-2	PLUG-PIPE-.25" PT	1	
8	4843526-7	ADAPTER-TILT	2	
	0921205-1	O-RING-#-910	2	
9	4776666-2	POPPET-RED	1	
10	4776665-4	POPPET-BLUE	1	
11	0920107-0	PLUG-.88"-14	2	
	0921205-1	O-RING-#-910	2	
12	4880496-7	SUPPORT ASSY-VALVE	1	
	0921969-2	CAPSCREW-.38"-16 X 1.50"	2	
	0916965-7	LOCKWASHER-.38"	2	
	0916950-9	NUT-.38"-16	2	
13	4841221-7	LINK	6	
	4843534-1	PIN-CLEVIS-.38"	6	
	0928197-3	RING RET. #37	10	
14	4880502-2	SHAFT	1	
	0915797-5	PIN-SPRING-.19" X 1.25"	1	
15	4880497-5	SPACER	1	
16	4890333-0	HANDLE ASSY-LIFT	1	INCL ITEM 19
17	4890332-2	HANDLE ASSY-TILT	1	INCL ITEM 19
18	0233770-7	KNOB-BLACK RUBBER	3	
19	0932857-6	BEARING	6	
20	4890331-4	HANDLE-SIDESHIFT	1	INCL ITEM 19

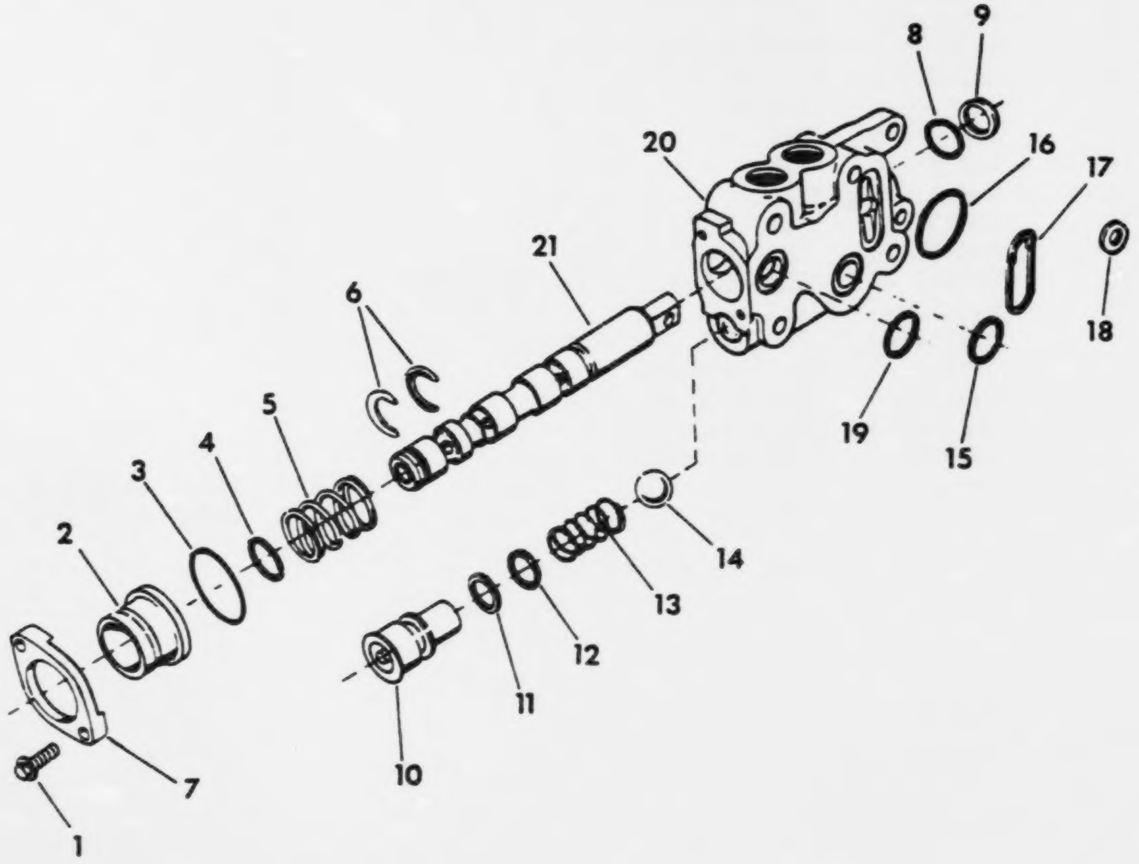

73921

PLUNGER SECTION ASSY-LIFT-4913456-2

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4908201-9	CAPSCREW	2	
2	4908202-7	SLEEVE	1	
3	0923989-8	*O-RING-#-024	1	
4	4753681-8	*O-RING	1	
5	4908203-5	SPRING	1	
6	4908204-3	C-WASHER	2	
7	4808205-0	RETAINER	1	
8	4908208-4	*O-RING	1	
9	4908209-2	*RING-BACKUP	1	
10	4908214-2	PLUG	1	
11	4908215-9	*RING-BACKUP	1	
12	0923548-2	*O-RING-#-111	1	
13	4908216-7	SPRING	1	
14	4908217-5	BALL	1	
15	4908213-4	*SEAL	1	
16	4908210-0	*SEAL	1	
17	4908211-8	RETAINER	1	
18	4908212-6	SHIM	4	
19	0926803-8	*SEAL-SQUARE CUT-#-118-.86"ID	1	
20	4908206-8	SPRING	1	
21	0927547-0	PLUG-SAE STD-.75"-16	1	
22	0921349-7	*O-RING-#-908	1	
23	4908207-6	VALVE-RELIEF	1	
24	0928208-8	PLUG-SAE STD-.88"-14	1	
25	0921205-1	*O-RING-#-910	1	
26	---------	SPOOL	1	ORDER 4913456-2 ASSY
27	---------	HOUSING	1	ORDER 4913456-2 ASSY

*INCL IN KIT 4908224-1

73921



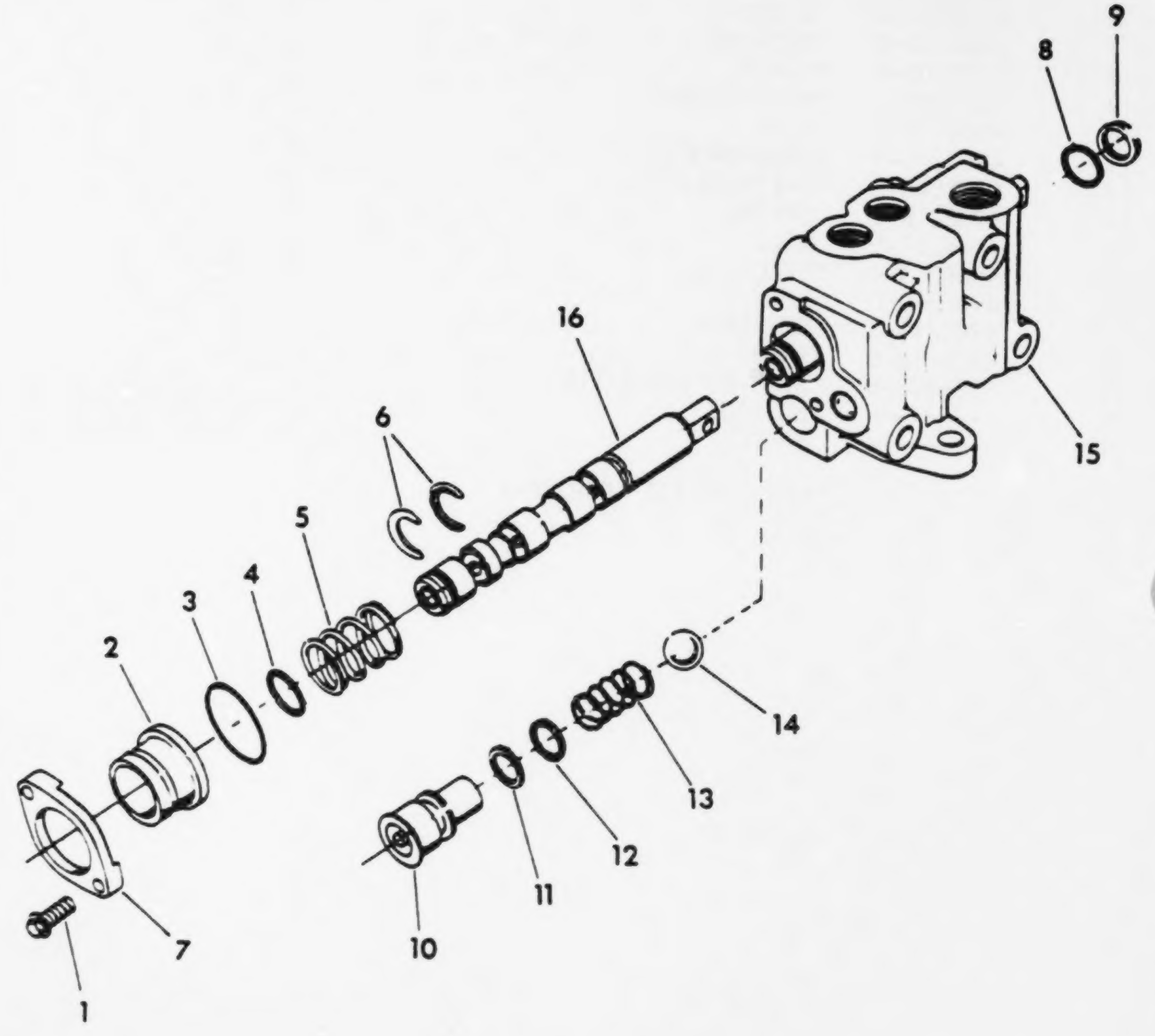
8
9
20
16
17
21
18
6
19
15
5
4
3
14
2
13
12
11
7
10
1

73923-73920-1

PLUNGER SECT ASSY-TILT-4913457-0

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4908201-9	CAPSCREW	2	
2	4908202-7	SLEEVE	1	
3	0923989-8	*O-RING-#-204	1	
4	4753681-8	*O-RING	1	
5	4908203-5	SPRING	1	
6	4908204-3	WASHER-C	2	
7	4908205-0	RETAINER	1	
8	4908208-4	*O-RING	1	
9	4908209-2	*RING-BACKUP	[illegible]	
10	4908214-2	PLUG	1	
11	4908215-9	*RING-BACKUP	1	
12	0923548-2	*O-RING-#-111	1	
13	4908216-7	SPRING	1	
14	4908217-5	BALL	1	
15	4908213-4	*SEAL	1	
16	4908210-0	*SEAL	1	
17	4908211-8	RETAINER	1	
18	4908212-6	SHIM	4	
19	0926803-8	*SEAL-SQ CUT-#-118	1	
20	---------	HOUSING	1	ORDER 4913457-0
21	---------	SPOOL	1	ORDER 4913457-0

*INCL IN KIT 4908224-1

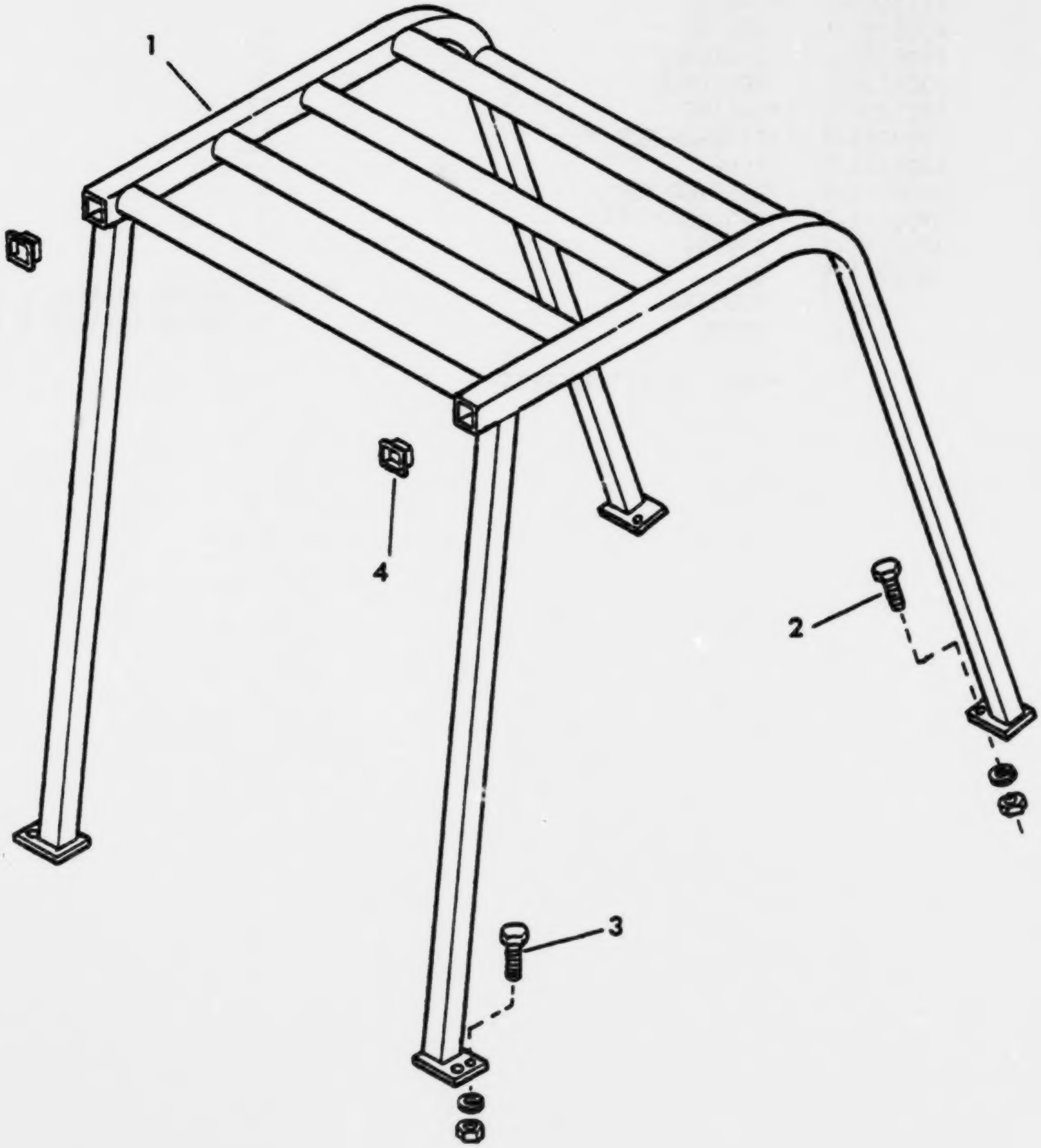

9
8
16
15
6
5
4
3
2
14
13
12
11
10
7
1

73922

PLUNGER SECT ASSY-OUTLET-4913458-8

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4908201-9	CAPSCREW	2	
2	4908202-7	SLEEVE	1	
3	0923989-8	*O-RING-#-204	1	
4	4753681-8	*O-RING	1	
5	4908203-5	SPRING	1	
6	4908204-3	C-WASHER	2	
7	4908205-0	RETAINER	1	
8	4908208-4	*O-RING	1	
9	4908209-2	*RING-BACKUP	1	
10	4908214-2	PLUG	1	
11	4908215-9	*RING-BACKUP	1	
12	0923548-2	*O-RING-#-111	1	
13	4908216-7	SPRING	1	
14	4908217-5	BALL	1	
15	---------	HOUSING	1	ORDER 4913458-8 ASSY
16	---------	SPOOL	1	ORDER 4913458-8 ASSY

*INCL IN KIT 4908224-1

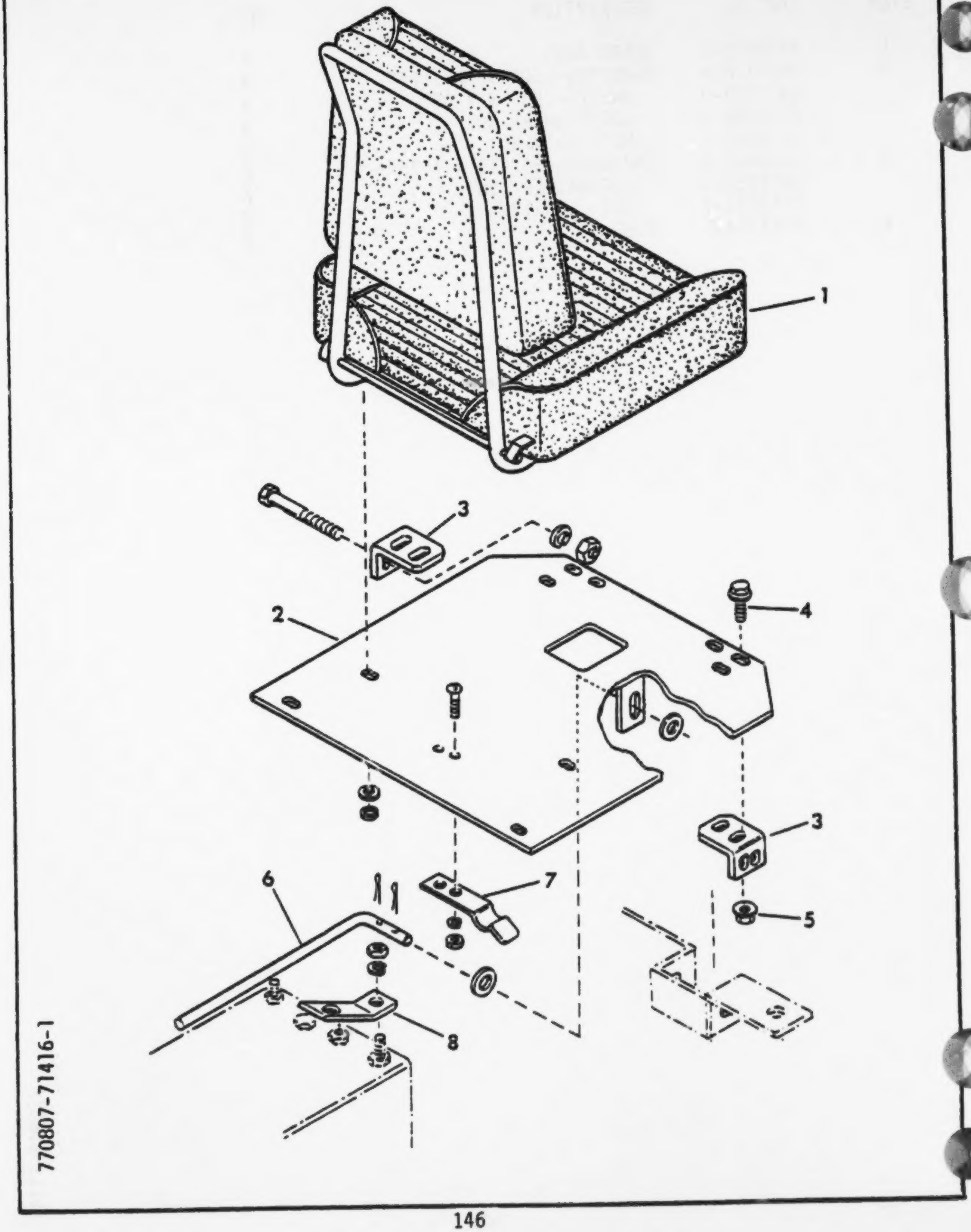


770944-71242-1

OVERHEAD GUARD

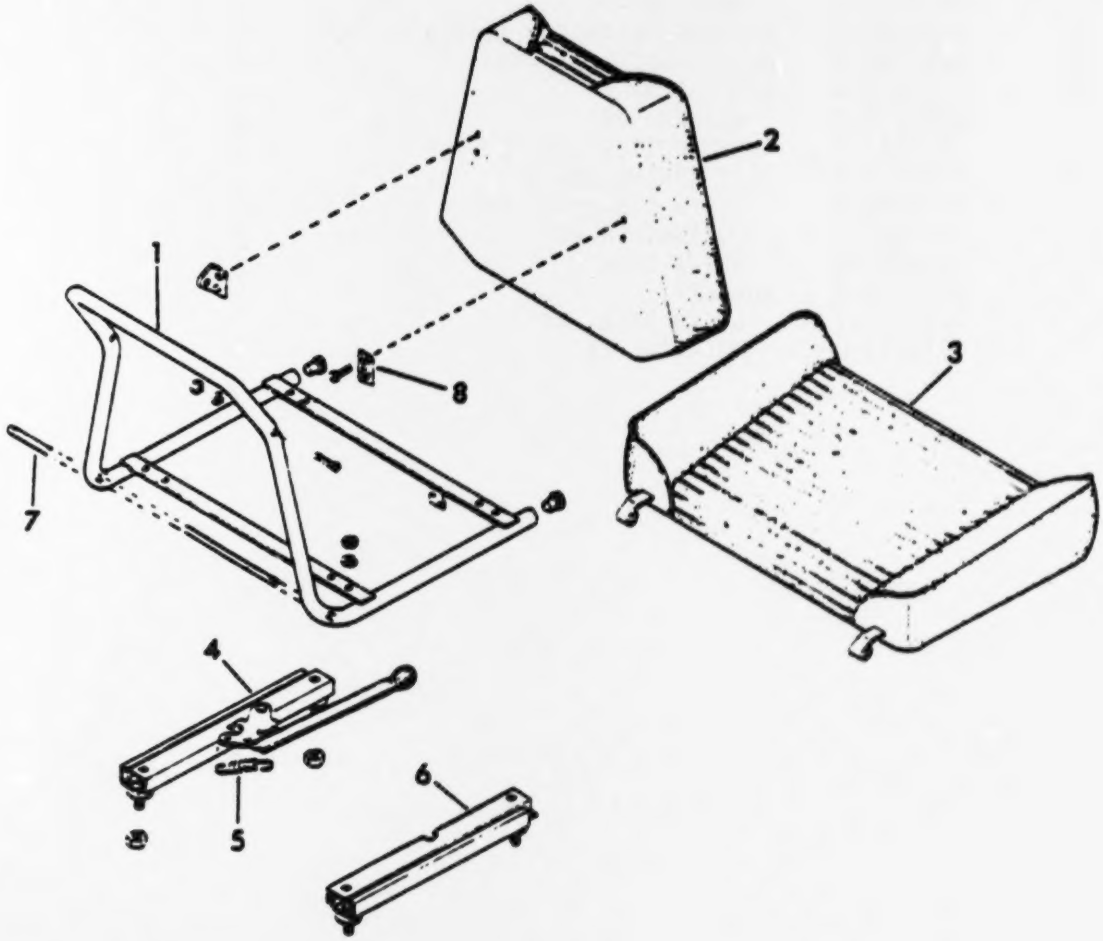
ITEM	PART NO.	DESCRIPTION	QTY.
1	4875573-0	GUARD ASSY	1
2	0921176-4	CAPSCREW-.50"-13 X 1.25"	4
	0917379-0	WASHER-.53" X 1.06"	4
	0916966-5	LOCKWASHER-.50"	4
	0916951-7	NUT-.50"-13	4
3	0919089-3	CAPSCREW-.50"-13 X 1.75"	2
	0916966-5	LOCKWASHER-.50"	2
	0916951-7	NUT-.50"-13	2
4	4846354-1	PLUG	2

770944-71242-1


770807-71416-1

SEAT

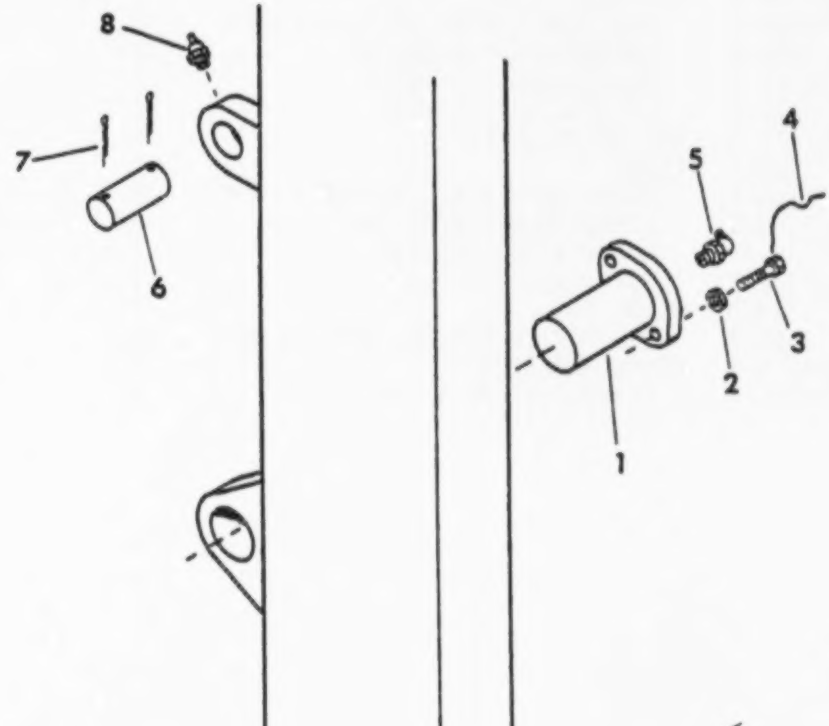
ITEM	PART NO.	DESCRIPTION	QTY.	
1	4842513-6	SEAT ASSY	1	SEE PAGE 149
	0918265-0	WASHER-.31"	4	
	0917356-8	LOCKWASHER-.31"	4	
2	4882371-0	PLATE-SEAT SUPPORT	1	
3	4844885-0	ANGLE-SEAT HINGE	2	
	0923938-5	CAPSCREW-.38"-16 X 3.50"	2	
	0916965-7	LOCKWASHER-.38"	2	
	0916950-9	NUT-.38"-16	2	
4	4255068-1	CAPSCREW-FLANGED-.31"-18 X .75"	4	
5	4255039-2	NUT-FLANGED-.31"-18	4	
6	4785009-4	BRACE-SEAT	1	
	0917378-2	WASHER-.38"	2	
	0918447-4	PIN-COTTER-.09" X .75"	2	
7	4844775-9	CLIP-SPRING-BRACE	1	
	0916080-5	SCREW-#10-24 X .50"	2	
	0917365-7	LOCKWASHER-#10	2	
	0916621-6	NUT-#10-24	2	
8	4833178-9	SUPPORT	1	
	0918199-1	LOCKWASHER-.44"	1	
	0918213-0	NUT-.44"-14	1	



73841

SEAT ASSY

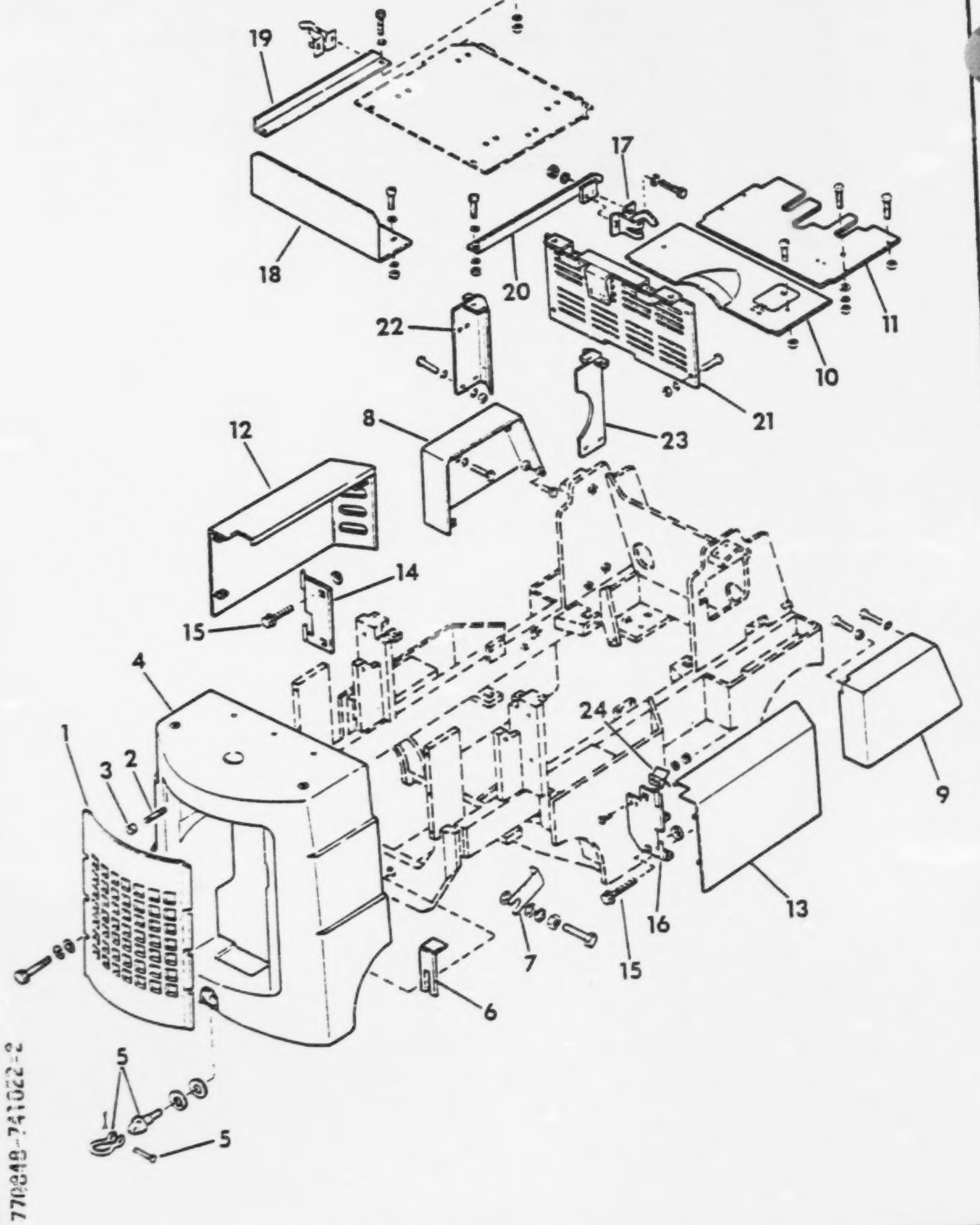
ITEM	PART NO.	DESCRIPTION	QTY.	
1	4910545-5	FRAME	1	INCL PLASTIC TIPS
	4906408-2	TIP-BLACK PLASTIC-.88"	2	
2	4828474-9	CUSHION-BACKREST	1	INCL ITEM 8
	0900537-2	SCREW-.25"-20 X 1.50"	2	
	0918264-3	WASHER-PLATED-.28"	2	
	0920329-0	NUT-STOP-.25"-20	2	
3	4907649-0	CUSHION-SEAT	1	
4	4907382-8	ADJUSTER-SLIDE	1	INCL ITEM 5
	0917366-7	CAPSCREW-PLATED-.31"-24 X .87"	2	
	0917356-8	LOCKWASHER-PLATED-.31"	2	
	0920263-1	NUT-PLATED-.31"-24	2	
	0917372-5	NUT-PLATED-.31"-18	2	
5	4907476-8	SPRING-ADJUSTER	1	
6	4907383-6	SLIDE	1	
	0917366-7	CAPSCREW-PLATED-.31"-24 X .87"	2	
	0917356-8	LOCKWASHER-PLATED-.31"	2	
	0920263-1	NUT-PLATED-.31"-24	2	
	0917372-5	NUT-PLATED-.31"-18	2	
7	4891714-0	HINGE PIN	1	
	0918448-2	PIN-COTTER-PLATED-.09" X 1.00"	2	
8	4906618-6	HINGE-BACKREST	2	
	0900576-0	SCREW-.25"-20 X .75"	4	



73601-56193-2

MAST MOUNTING

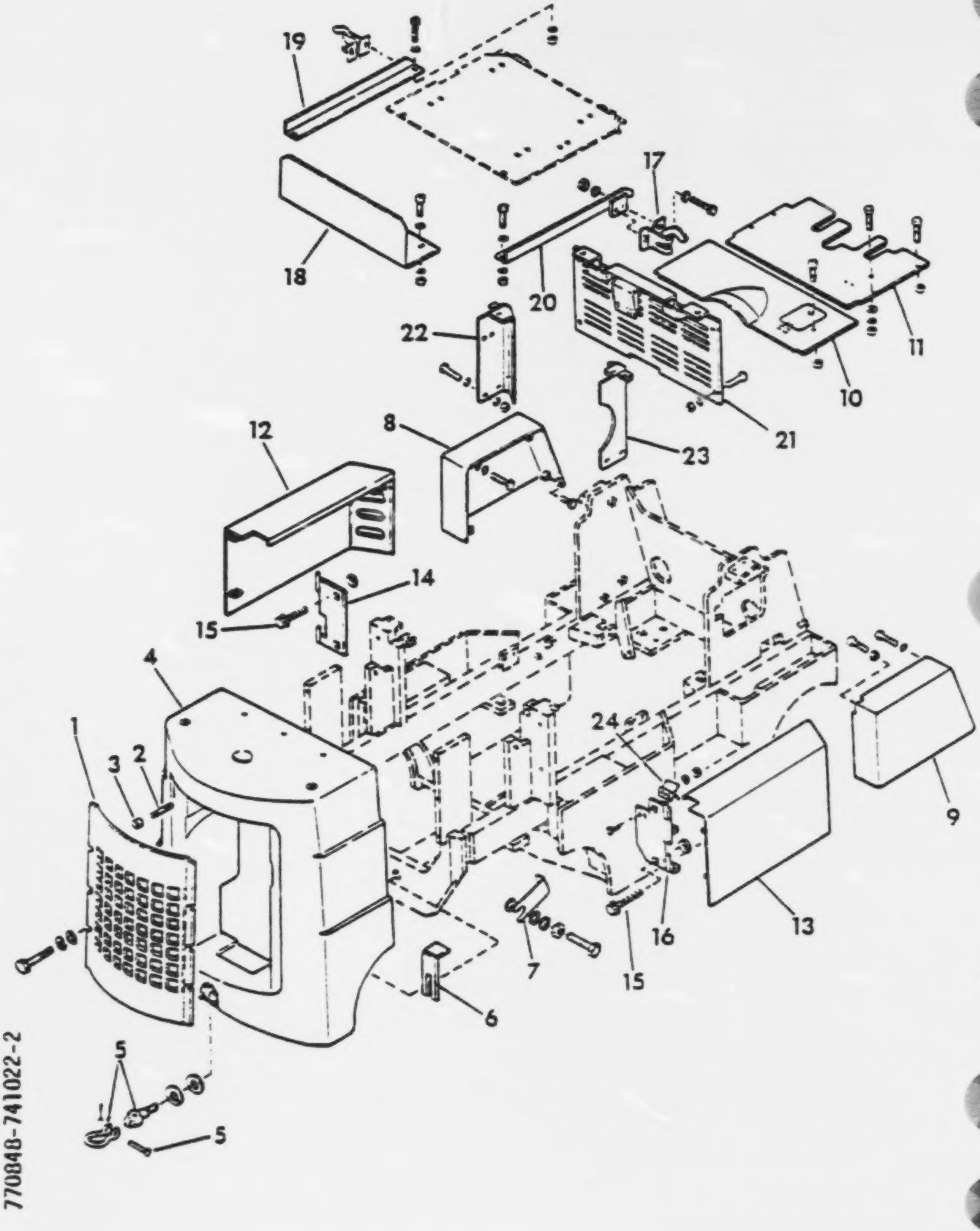
ITEM	PART NO.	DESCRIPTION	QTY.
1	4718482-5	PIN-MAST	2
2	0916965-7	LOCKWASHER-.38"	4
3	4335601-3	CAPSCREW-.38"-16 X 1.25"	4
4	4742113-6	WIRE	2
5	0915276-0	FITTING-LUBE-65°	2
6	4826276-0	PIN	2
7	0919430-9	PIN-COTTER-.16" X 1.25"	4
8	0918187-6	FITTING-LUBE-45°	2
	0911406-7	WASHER	2


770848-741022-2

SHEET METAL

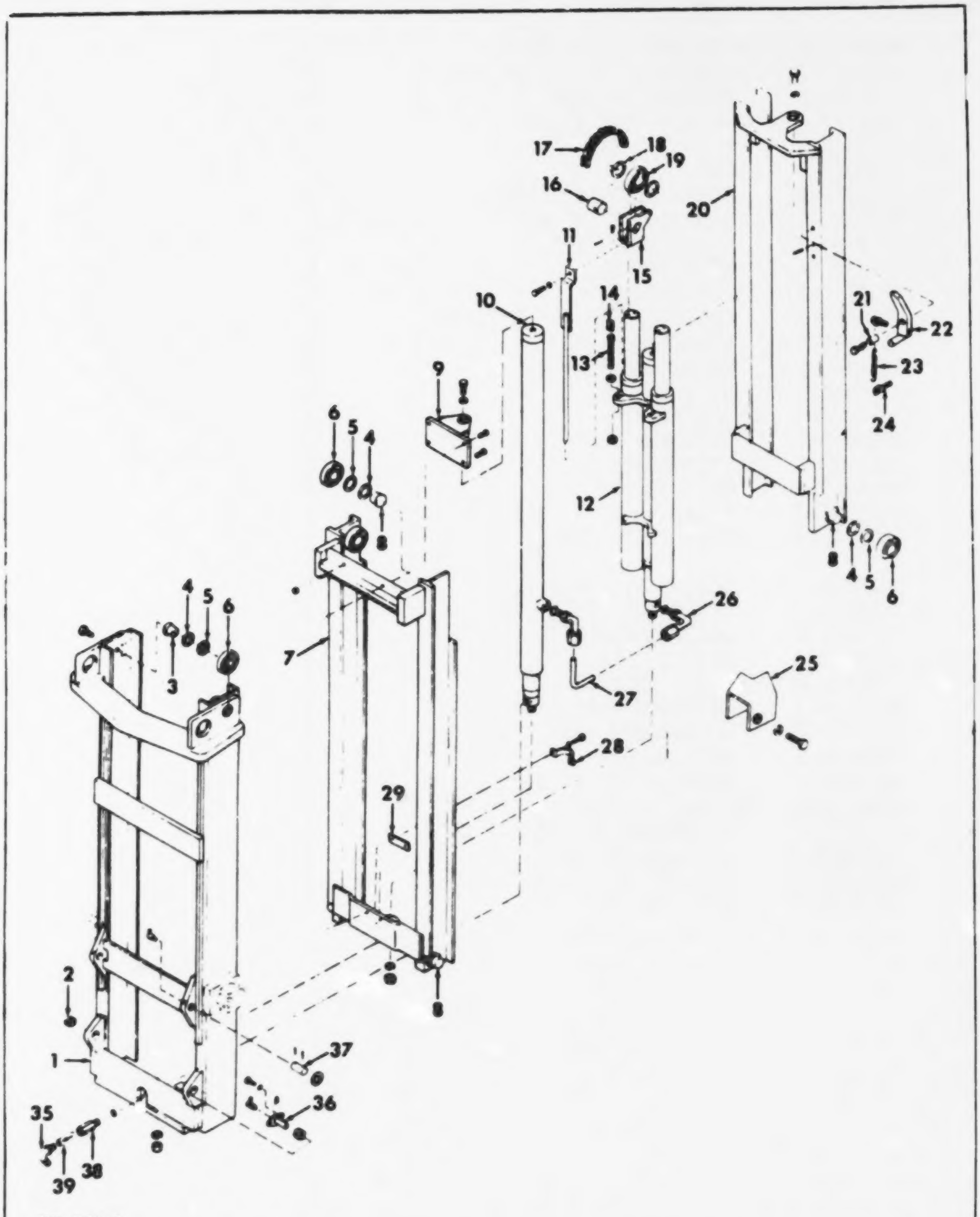
ITEM	PART NO.	DESCRIPTION	QTY.
1	4885303-0	GRILL-RADIATOR	1
	0921969-2	CAPSCREW-.38"-16 X 1.50"	4
	0920743-2	WASHER-.44" X 1.25"	4
	0916965-7	LOCKWASHER-.38"	4
2	4864097-3	ROD	4
	0918266-8	WASHER-.41" X .81"	4
	0916965-7	LOCKWASHER-.38"	4
	0916950-9	NUT-CAP-.38"-16	4
3	4857258-0	SPACER	4
4	4856671-5	COUNTERWEIGHT	1
5	4821003-3	STUD-TOWING	1
	0929327-5	LOCKWASHER-1.56"	1
	0929326-8	WASHER-1.38"	1
	0920571-7	SPACKLE-.62"	1
6	4874220-9	SHIM-COUNTERWEIGHT	* AS REQ
7	4878164-5	SHIM-COUNTERWEIGHT	* AS REQ
	0918269-2	WASHER-.81" X 1.50"	4
	0919332-7	LOCKWASHER-.75"	2
	0922037-7	NUT-JAM-.75"10	2
	0924234-8	SCREW-ADJ-.75"10 X 4.00"	2
8	4820955-5	COWL-LH	1
	0921977-5	CAPSCREW-.31"-18 X 1.25"	3
	0917356-8	LOCKWASHER-.31"	3
	0925670-2	SCREW-.31"-18 X 1.00"	1
	0921355-4	NUT-SPEED-.31"-18	1
9	4861547-0	COWL-RH	1
	0921977-5	CAPSCREW-.31"-18 X 1.25"	3
	0917356-8	LOCKWASHER-.31"	3
	0925670-2	SCREW-.31"-18 X 1.00"	1
	0921355-4	NUT-SPEED-.31"-18	1
10	4864169-7	PLATE ASSY-FLOOR	1
	0925670-2	SCREW-.31"-18 X .75"	2
	0921355-4	NUT-SPEED-.31"-18	2
11	4861163-6	PLATE-TOE	1
	0921332-3	CAPSCREW-.31"-18 X .75"	4
	0921355-4	NUT-SPEED-.31"-18	4
	0921969-2	CAPSCREW-.38"-16 X 1.50"	1
	0916950-9	NUT-.38"-16	1
	0921705-0	NUT-RETAINER-.38"-16	1
	0917378-2	WASHER-.44" X 1.00"	1
12	4880720-0	PANEL ASSY-SIDE LH	1
13	4880722-6	PANEL ASSY-SIDE RH	1
14	4873188-9	HINGE ASSY-LH	1
	0924356-9	WASHER-.41" X 1.50"	2
15	4255060-8	SCREW-FLANGED-.38"-16 X 1.00"	4
16	4873189-7	HINGE ASSY-RH	1
	0924356-9	WASHER-.41" X 1.50"	2

CONTINUED


770848-741022-2

SHEET METAL (CONTINUED)

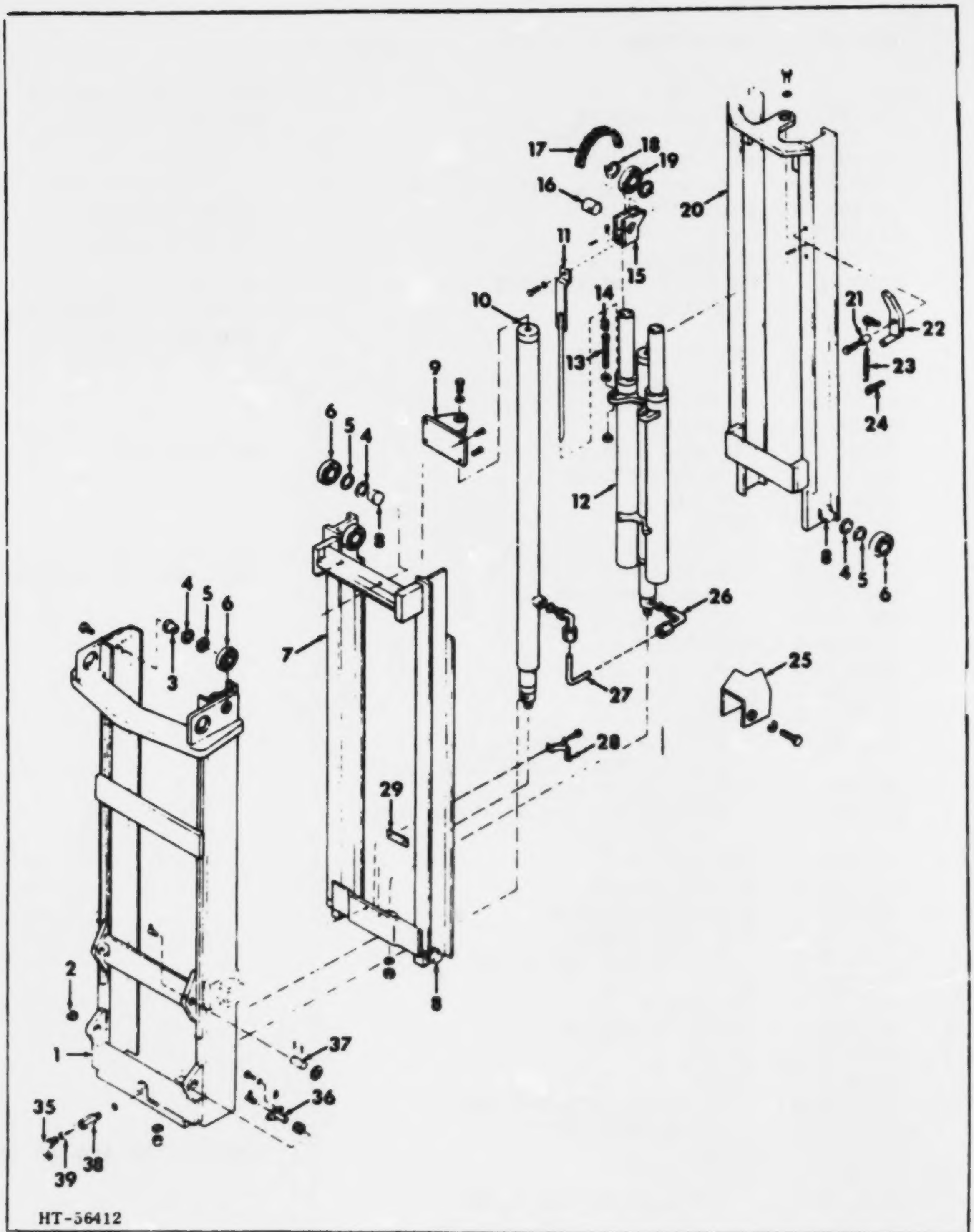
ITEM	PART NO.	DESCRIPTION	QTY.
17	4879818-5	LATCH ASSY-SIDE PANEL	2
	0923341-2	CAPSCREW-.25"-20 X .75"	4
	0916964-0	LOCKWASHER-.25"	4
	0926327-8	WASHER-.28" X .62"	4
	0916622-4	NUT-.25"-20	4
18	4820995-1	GUARD	1
	0916532-5	SCREW-.25"-20 X .75"	2
	0929361-4	WASHER-.28" X .62"	4
	0916964-0	LOCKWASHER-.25"	2
	0916622-4	NUT-.25"-20	2
19	4880714-3	ANGLE-TIE-LH	1
	0920415-7	CAPSCREW-.38"-16 X 1.25"	2
	0916965-7	LOCKWASHER-.38"	2
	0918266-8	WASHER-.41" X .81"	3
	0916950-9	NUT-.38"-16	2
20	4887288-1	ANGLE-TIE-RH	1
	0920415-7	CAPSCREW-.38"-16 X 1.25"	2
	0916965-7	LOCKWASHER-.38"	2
	0916950-9	NUT-.38"-16	2
	0918266-8	WASHER-.41" X .81"	3
21	4869549-8	SCREEN ASSY-FRONT	1
	0922035-1	SCREW-.31"-18 X 1.00"	2
	0918249-4	SCREW-.31"-18 X .75"	2
	0917356-8	LOCKWASHER-.31"	4
	0917372-5	NUT-.31"-18	4
22	4880716-8	SUPPORT ASSY-LH	1
	0920415-7	CAPSCREW-.38"-16 X 1.25"	2
	0916965-7	LOCKWASHER-.38"	2
	0916950-9	NUT-.38"-16	2
	0918266-8	WASHER-.41" X .81"	2
23	4880718-4	SUPPORT ASSY-RH	1
	0920415-7	CAPSCREW-.38"-16 X 1.25"	2
	0916965-7	LOCKWASHER-.38"	2
	0918266-8	WASHER-.41" X .81"	1
	0916950-9	NUT-.38"-16	2



HT-56412

MAST ASSEMBLY

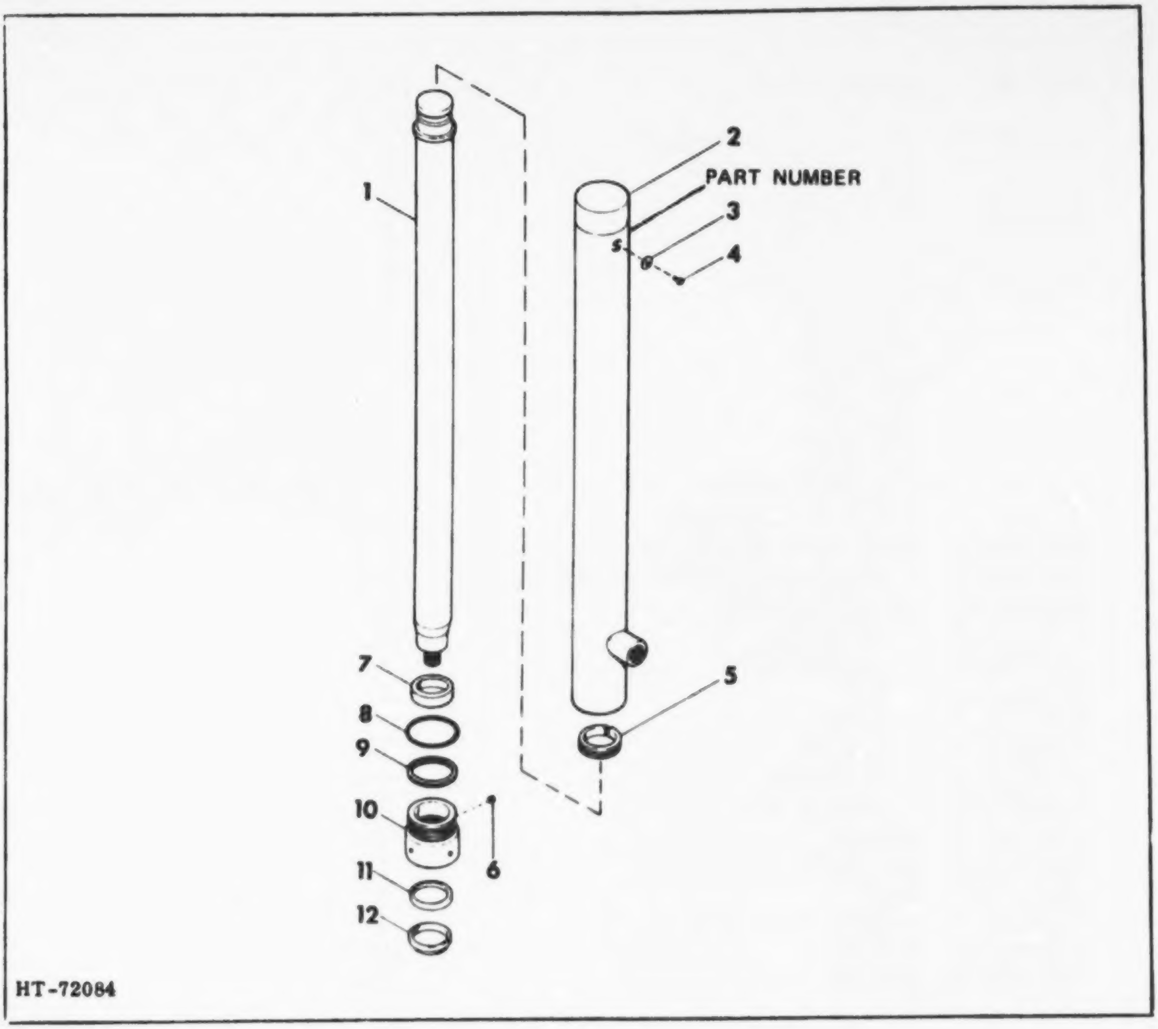
ITEM	PART NO	DESCRIPTION	QUANTITY	
-	-------	LIFT ASSY	1	INCL ITEMS 1 THRU 39
1	4867959-1	MAST ASSY-OUTER	1	INCL ITEM 2
2	4715712-8	BUSHING-MAST PIVOT	2	
3	4812974-6	STUD-ROLLER	2	
	0927519-9	CAPSCREW-GR 8-.62"-11 X 1.5"	2	
4	4812930-8	SHIM-.015	*	USE AS REQUIRED
5	4812929-0	SHIM-.040"	*	USE AS REQUIRED
6	4812920-9	BEARING-ROLLER	8	
7	4856552-7	MAST ASSY-INTERMEDIATE	1	INCL 4 OF ITEM 8
8	4839752-5	STUD-ROLLER	4	WELDED TO INTERMEDIATE AND INNER MASTS
9	4929288-9	BRACKET-CYLINDER	1	
	0919433-3	CAPSCREW-GR 5-.5"-20 X 2"	2	
	0923293-5	CAPSCREW-GR 5-.5"-20 X 1.75"	2	
	0923805-6	NUT-LOCK	4	
10	4839271-6	CYLINDER ASSY-LIFT	1	SEE PAGE 160
	0917373-3	LOCKWASHER-.62"	1	
	0921342-2	NUT-LOCK	1	
11	4816113-7	GUARD	2	
12	4863123-8	CLUSTER-LIFT CYLINDER	1	SEE PAGE 163
	0929533-8	CAPSCREW-GR 5-.62"-18 X 3.25"	2	INNER MAST TO CLUSTER
	0917373-3	LOCKWASHER-.62"	2	
	0921342-2	NUT-LOCK-.62"-18	2	
13	4765796-0	ANCHOR-CHAIN	2	
	0919333-5	NUT-.75"-16	4	
14	4701704-1	LINK-CHAIN	2	
15	4829757-6	CROSSHEAD	2	
	0926681-8	SCREW-GR 5-FL HD-HEX SOC W/NYLOK INSERT-.38"-16 X 1.25"	4	
16	4812935-7	PIN-CROSSHEAD BEARING	2	
	0921464-4	SETSCREW-HEX SOC-HALF-DOG POINT .15"-20 X .5"	2	
17	4719720-7	CHAIN-LIFT	2	
18	4813781-4	WASHER-SPACING	4	
19	4803599-2	BEARING-CROSSHEAD	2	
20	4867958-3	MAST ASSY-INNER	1	
	4828179-4	PIN-SPRING-.19" X .75"	1	
21	0920161-7	NUT	1	
22	4829621-4	INTERLOCK	1	
23	4828568-8	SPRING-INTERLOCK	1	
24	0916713-1	SCREW	1	
25	4819814-7	GUARD	1	
	0921966-8	CAPSCREW-.38"-16 X .88"	1	
	0916965-7	LOCKWASHER-.38"	1	
26	4816684-7	ELBOW	2	INCL O-RING AND NUT UNIT
	4905843-1	NUT UNIT	2	
	0921206-9	O-RING-#912-TYPE 1-.93"	2	



HT-56412

MAST ASSEMBLY

ITEM	PART NO	DESCRIPTION	QUANTITY	
27	4817087-2	TUBE-LIFT CYLINDER TO CYLINDER CLUSTER	1	
28	4816376-0	CLAMP-CYLINDER	1	
	0925205-7	CAPSCREW-.31"-18 X .62"	2	
	0917356-8	LOCKWASHER-.31"	2	
29	4816375-2	SPACER-CLAMP	1	
30		NOT USED		
31		NOT USED		
32		NOT USED		
33		NOT USED		
34		NOT USED		
35		NOT USED		
36	------	PIN-MAST PIVOT	2	SEE MAST MOUNTING GROUP
37	------	PIN-TILT CYLINDER	2	
38	4821743-4	BODY-FLOW REGULATOR	1	
	0921206-9	O-RING-#912-TYPE 1-.93" ID	1	
39	4821902-6	REGULATOR-FLOW	1	
	0920787-9	CAPSCREW	2	
	0917356-8	LOCKWASHER	2	
	0930450-2	NUT	2	
	0921728-2	ELBOW	1	
	0921206-9	O-RING	1	
	0916713-1	SETSCREW	1	
	0918448-2	COTTER PIN	2	
	0916965-7	WASHER	1	
	0921966-8	CAPSCREW	1	
	4816113-7	ROD	2	
	4813781-4	WASHER-CROSSHEAD	4	
	4812930-8	SPACER	10	
	4812929-0	SPACER	6	

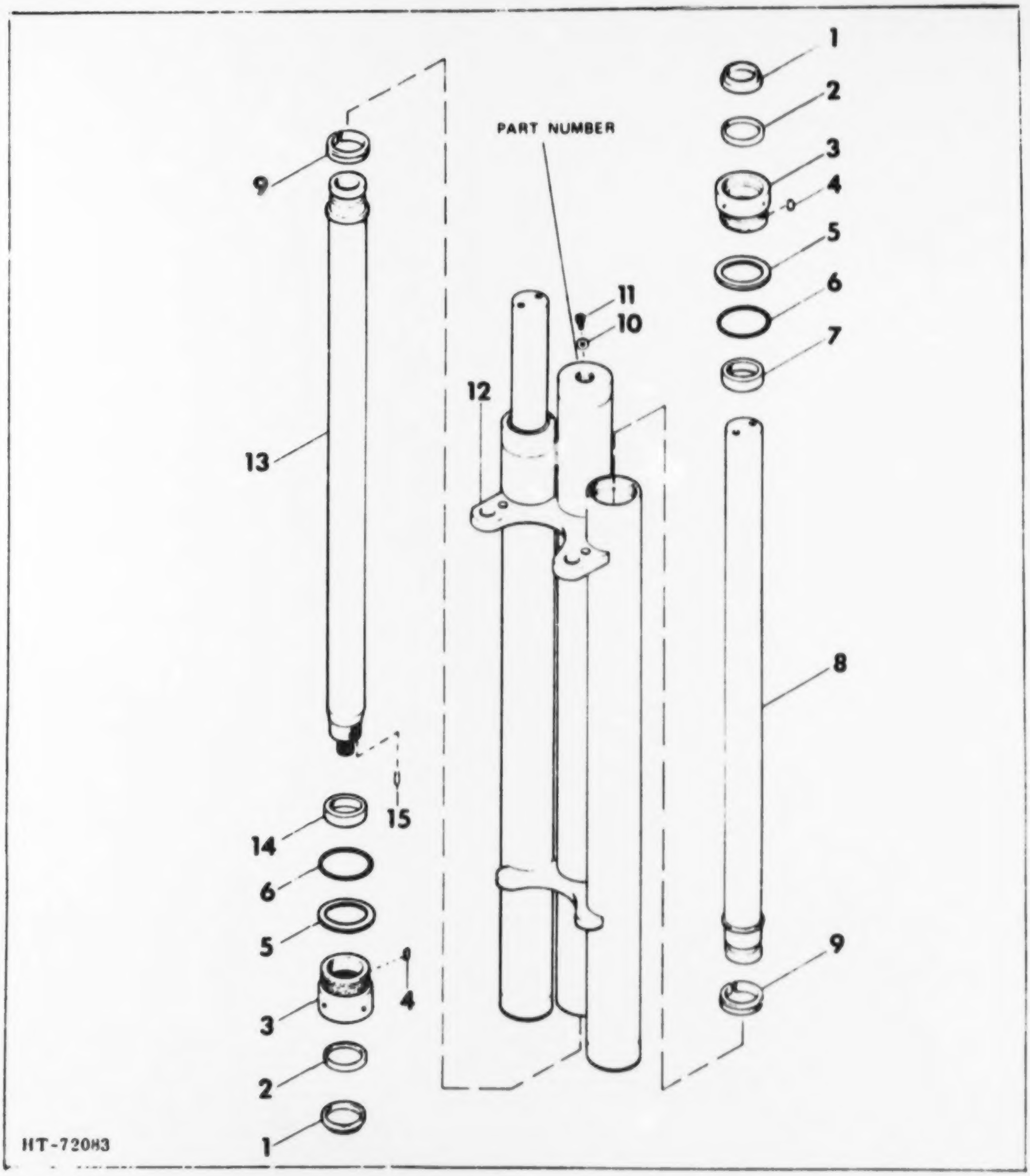


LIFT CYLINDER - 4839271-6

ITEM	PART NO.	DESCRIPTION	QTY.
1	4839274-0	RAM	1
2	4839272-4	TUBE	1
3	4833571-5	WASHER-NYLON	1
4	0929652-6	SCREW-BLEED	1
5	4816747-2	*RING-WEAR	1
6	4816749-8	*PELLET-NYLON	2
7	NOT USED		
8	0924093-8	*PACKING	1
9	0926624-8	*WASHER-BACKUP	1
10	4816708-4	NUT-GLAND	1
11	4816748-0	*PACKING-ROD	1
12	4816947-8	*RING-WIPER	1

*INCLUDED IN KIT 4906100-5

MEMO

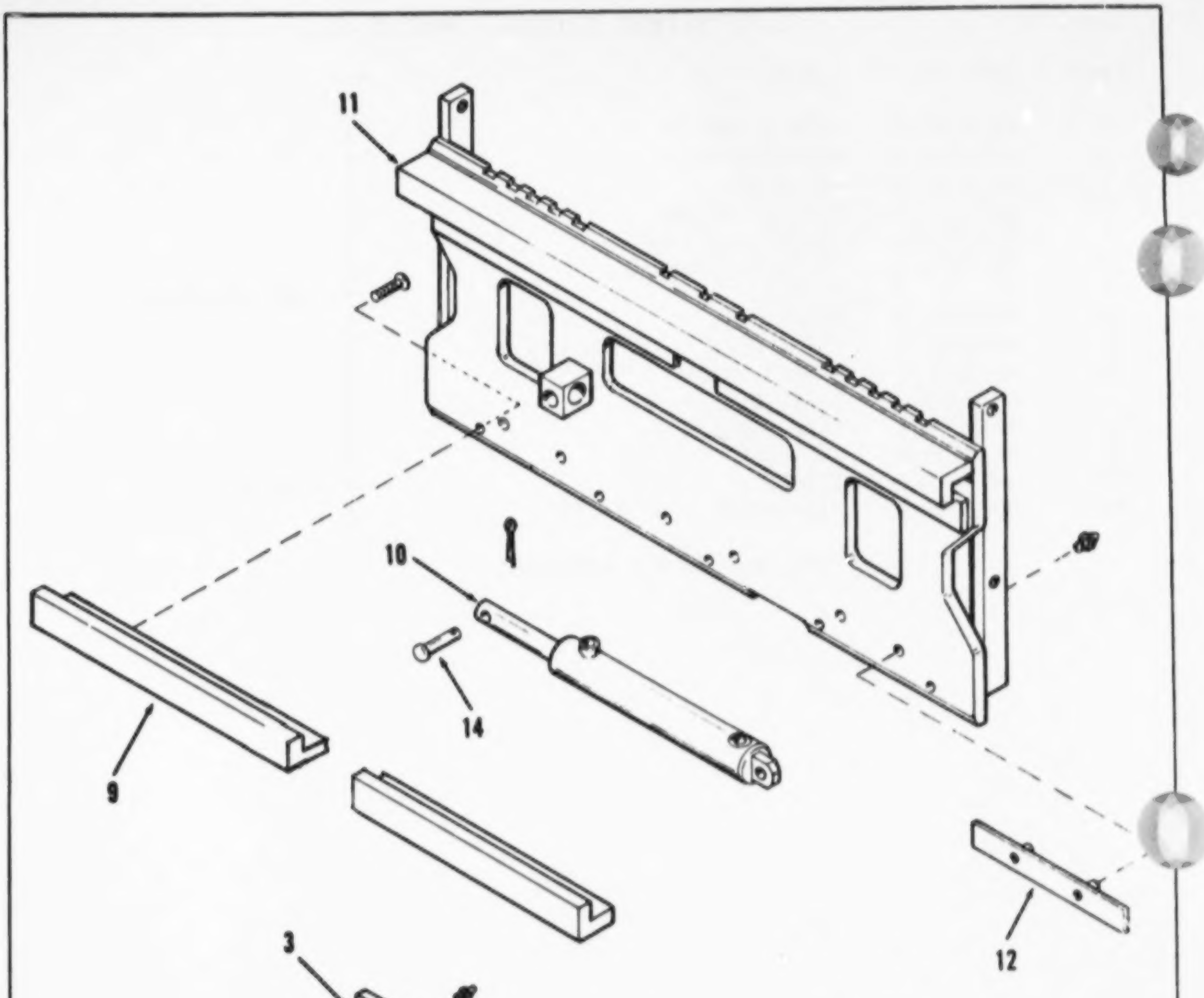

1
2
3
4
5
6
7
PART NUMBER
11
10
12
9
13
8
15
14
6
5
4
3
9
2
1
HT-72083

LIFT CYLINDER CLUSTER

LIFT CYLINDER CLUSTER - 4863123-8

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4816947-8	*WIPER-ROD	3	
2	4816748-0	*PACKING-ROD	3	
3	4816708-4	NUT-GLAND	3	
4	4816749-8	*PELLET-NYLON	6	
5	0926624-8	*WASHER-BACK-UP	3	
6	0924093-8	PACKING CLASS 1B	3	
7	---------	SPACER	2	NOT REQUIRED
8	4848948-8	ROD-SHORT	2	
9	4885085-3	*RING-WEAR	6	
10	4833571-5	WASHER-NYLON	3	
11	0929652-6	SCREW-BLEED	3	
12	4839277-3	TUBE-CLUSTER	1	
13	4839404-3	ROD-LONG	1	
14	---------	SPACER	*	NOT REQUIRED
15	0922946-9	PIN-SPIROL-.25" X .75"	1	

*INCLUDED IN KIT 4906099-1



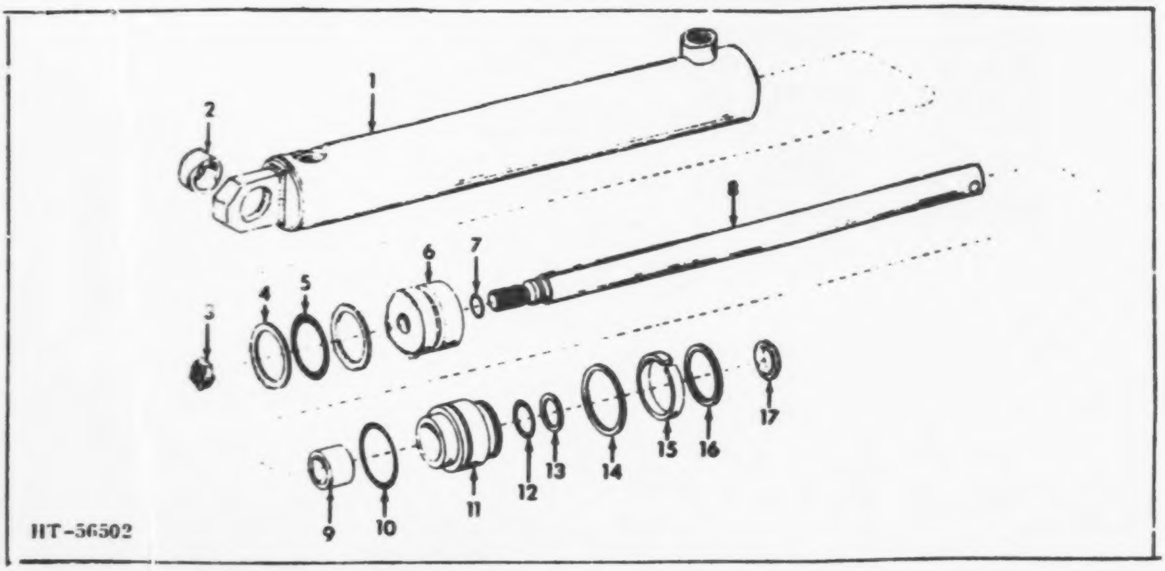
SIDE SHIFT CARRIAGE

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4822814-2	ANGLE-WEAR	3	
	0914687-9	FITTING-LUBRICATION	6	
-		CARRIAGE ASSY-INCL ITEMS 2 THRU 14	1	
	0921672-2	CAPSCREW- .62"-11 x 1	2	
	0917373-2	LOCKWASHER- .62"	2	
	0912279-7	CAPSCREW-HEX SOC- .50"-13 x 1.75"	2	
	0920428-0	LOCKWASHER-EXT- .50"	2	
	0913744-9	NUT- .50"-13	2	
2	4701704-1	LINK-CONNECTING	2	
	0919313-7	PIN-COTTER	4	
3	4823331-6	FRAME-CARRIAGE-INCL ITEMS 4 AND 8	1	
4	4839751-7	STUD-ROLLER WELDED TO SUPPORT	2	
5	4812930-8	SHIM- .015 (AS REQUIRED)	*	
6	4812929-0	SHIM- .040 (AS REQUIRED)	*	
7	4812920-9	BEARING	6	
	0926680-0	SCREW-HEX SOC- .25" -20 x 2"	2	
8	4839752-8	STUD-WELDED TO SUPPORT	4	
9	4835376-7	BAR-HANGER-LOWER	1	
	0927449-9	SCREW-HEX SOC- .38"-16 x 1.5"	6	
10	4809524-4	CYLINDER ASSY-SIDE SHIFT	1	SEE PAGE 166
11	4822618-7	PLATE-SIDE SHIFT	1	
12	4822811-8	STRIP-WEAR	3	
	0914687-9	FITTING-LUBRICATION	6	
13	4809584-8	PIN-CYLINDER	1	
	0918452-4	PIN-COTTER	1	
14	4909834-7	PIN-ROD END	1	
	0918451-6	PIN-COTTER	1	
	4817727-3	SPACER	1	
	0926705-5	CAPSCREW .62-11 x 1.50"	1	
	4834705-8	BUSHING	1	

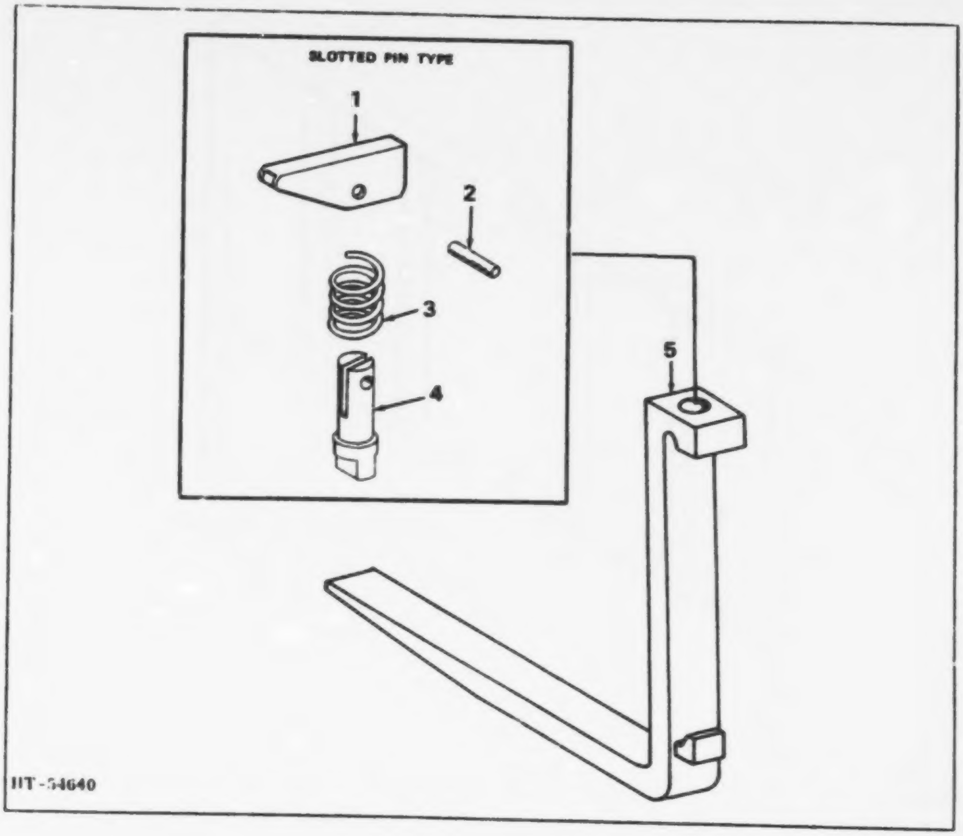
CYLINDER ASSEMBLY

ITEM	PART NO.	DESCRIPTION	QTY.
1	4999620-0	TUBE	1
2	4998682-1	BUSHING	1
3	4907479-2	NUT-JAM	1
4	4998612-8	*WASHER-BACKUP	2
5	0923826-2	*O-RING	2
6	4998178-0	PISTON	1
7	0923376-8	*SEAL-ROD	1
8	4999621-8	ROD	1
9	4906179-9	BUSHING	1
10	0924114-2	*SEAL-HEAD	1
11	4906800-0	HEAD	1
12	0923810-6	*O-RING-ROD	1
13	4905864-7	*WASHER-BACKUP	1
14	0927814-4	*RING-LOCK	1
15	4998176-4	SPACER	1
16	0927849-0	RING-LOCK	1
17	4905864-7	*WASHER-BACKUP	1

*INCLUDED IN KIT 4906113-8



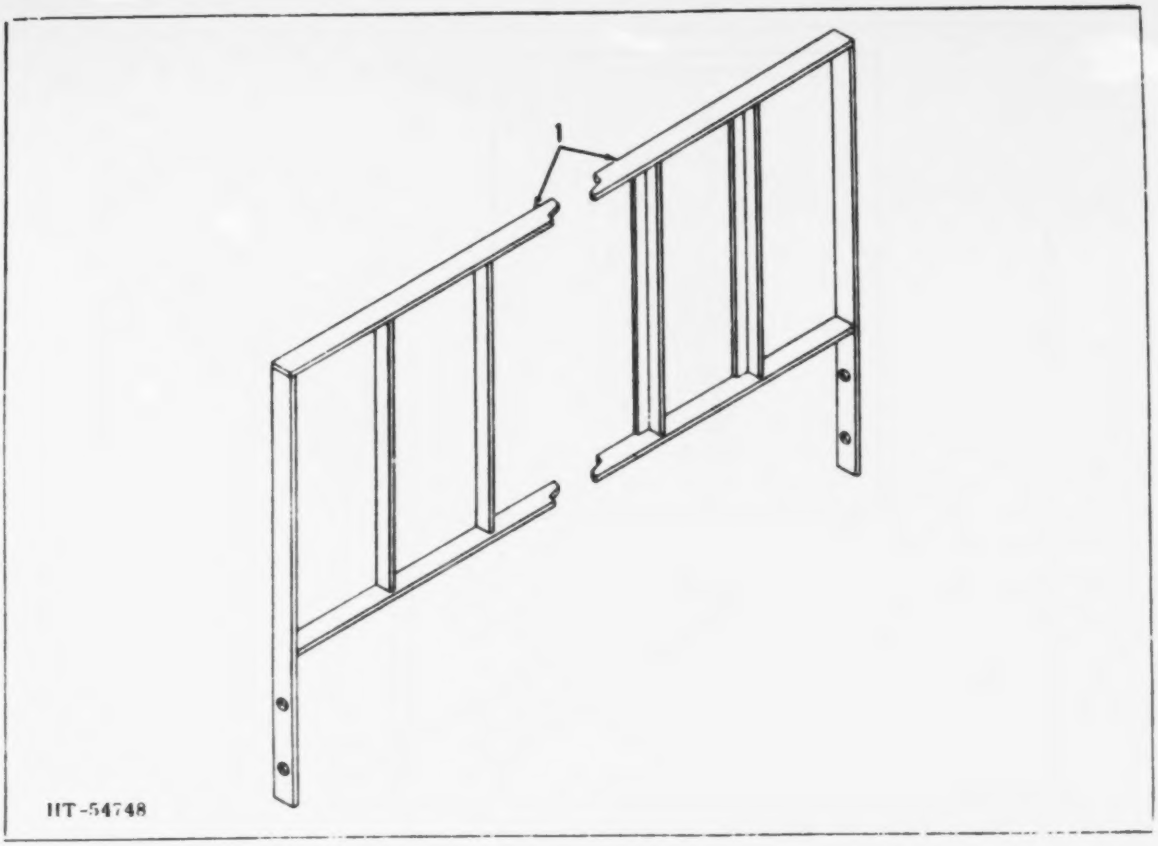
CYLINDER ASSY-4809524-4


SLOTTED PIN TYPE
1
2
3
4
5
HT-54640

FORK COMPONENTS

ITEM	PART NO.	DESCRIPTION	QTY.
1	4894676-8	*LATCH	2
2	0919169-6	*PIN-SPRING	2
3	4894675-0	*SPRING-LOCK	2
4	4894674-3	*PIN-LOCK	2
5	4877430-1	FORK	2

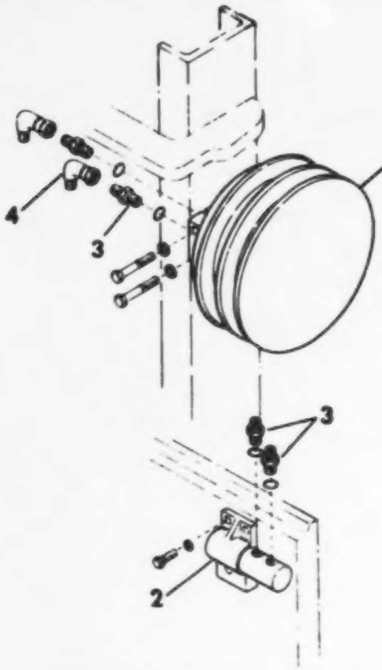
*INCL IN KIT 4910734-5



HT-54748

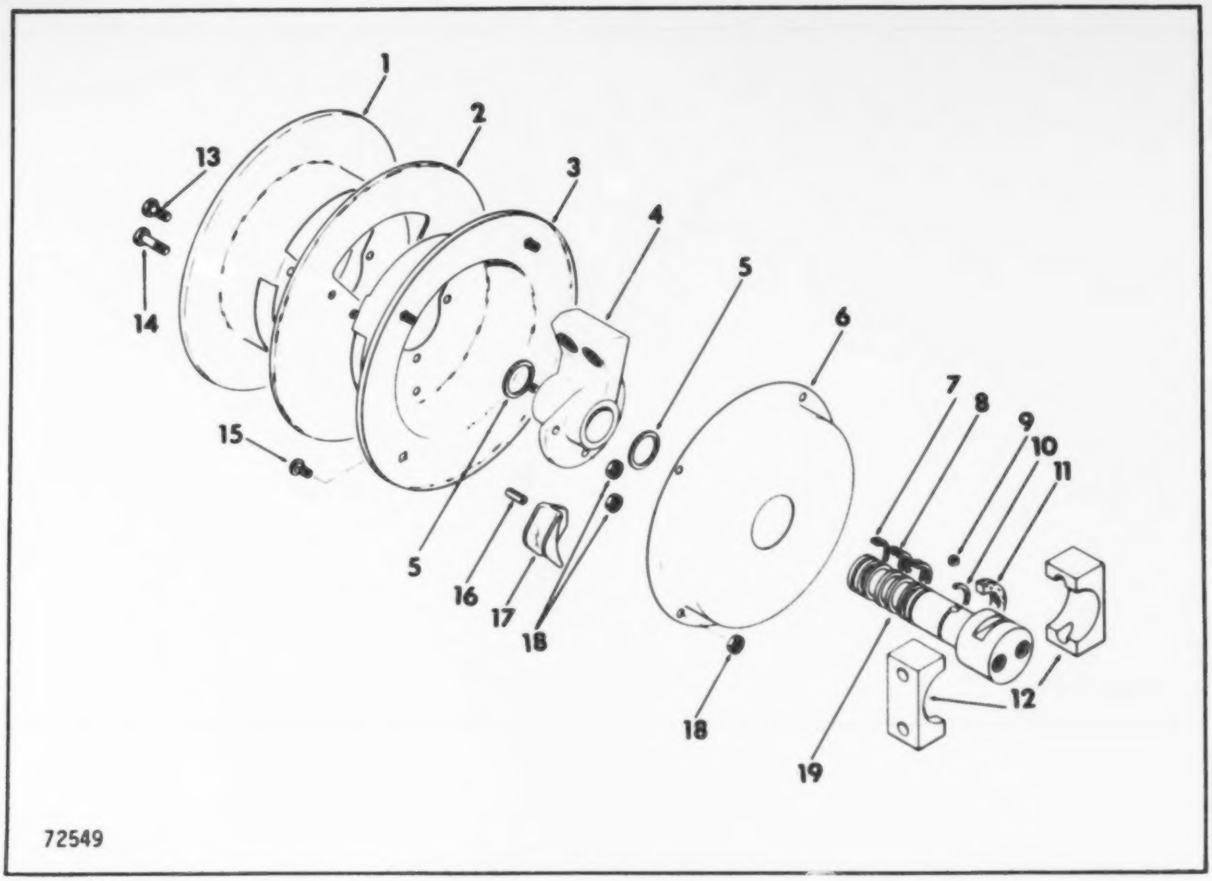
CARRIAGE BACKREST

ITEM	PART NO.	DESCRIPTION	QTY.
1	4823097-3	BACKREST ASSY	1
	4254797-6	STUD-WELDED	2
	4819216-5	WASHER	2
	0922645-7	CAPSCREW	2
	0923858-6	WASHER	2
	0916966-5	LOCKWASHER	2
	0916951-7	NUT	2



REEL GROUP - R.H.

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4844555-5	REEL	1	SEE PAGE 170
	0923320-6	CAPSCREW- .5"-13 x 3"	2	
	0916966-5	LOCKWASHER- .5"	2	
2	4844690-0	BLOCK-JUNCTION	1	SEE PAGE 171
	0921333-1	CAPSCREW- .31"-18 x 1"	2	
	0917356-8	LOCKWASHER- .31"	2	
3	0921409-9	CONNECTOR- .5" TUBE x .75"-16	4	INCL O-RING
	0921349-7	O-RING- #-908-.644" ID	4	SAE TYPE 1
4	0921279-6	ELBOW-90°- .5" TUBE x .75"-16	2	
5	4844692-6	BLOCK, MOUNTING		
	0923320-6	CAPSCREW- .5-13 x 3.00	2	
	0916966-5	LOCKWASHER .5"	2	

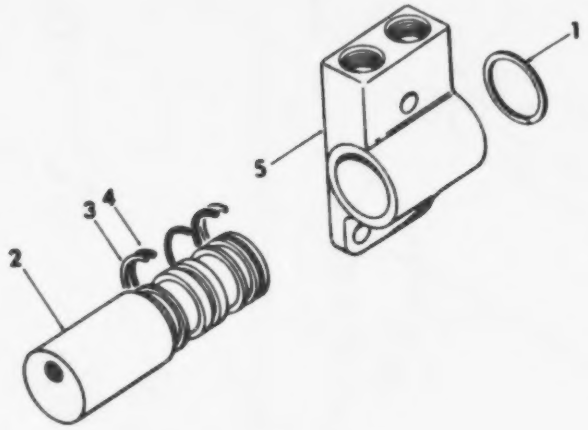


HOSE REEL ASSEMBLY- 4844555-5

ITEM	PART NO.	DESCRIPTION	QTY.
1	C645989	FLANGE	1
2	C-645977	DIVIDER	1
3	C645978	FLANGE	1
4	C-646064	HUB	1
5	C-7194	RING-SNAP	2
6	C-646250	SPRING	1
7	C-648569	*RING-BACK-UP	4
8	C-2715	*O-RING	3
9	C-645982	SPRING-RETAINING	1
10	C-7337	RING-SNAP	1
11	C-649055	SEAL-FELT	1
12	C-646246	BLOCK-MOUNTING	2
13	C-3552	CAPSCREW	3
14	C-3554	CAPSCREW	3
15	C-649106	CAPSCREW	4
16	C-7912	PIN-ROLL	1
17	C-646075	GUIDE-HOSE	2
18	C-645986	NUT	10
19	C-646079	SHAFT	1

*INCLUDED IN KIT C646081

NOTE: ORDER COMPONENT PARTS FROM CASCADE (02614)



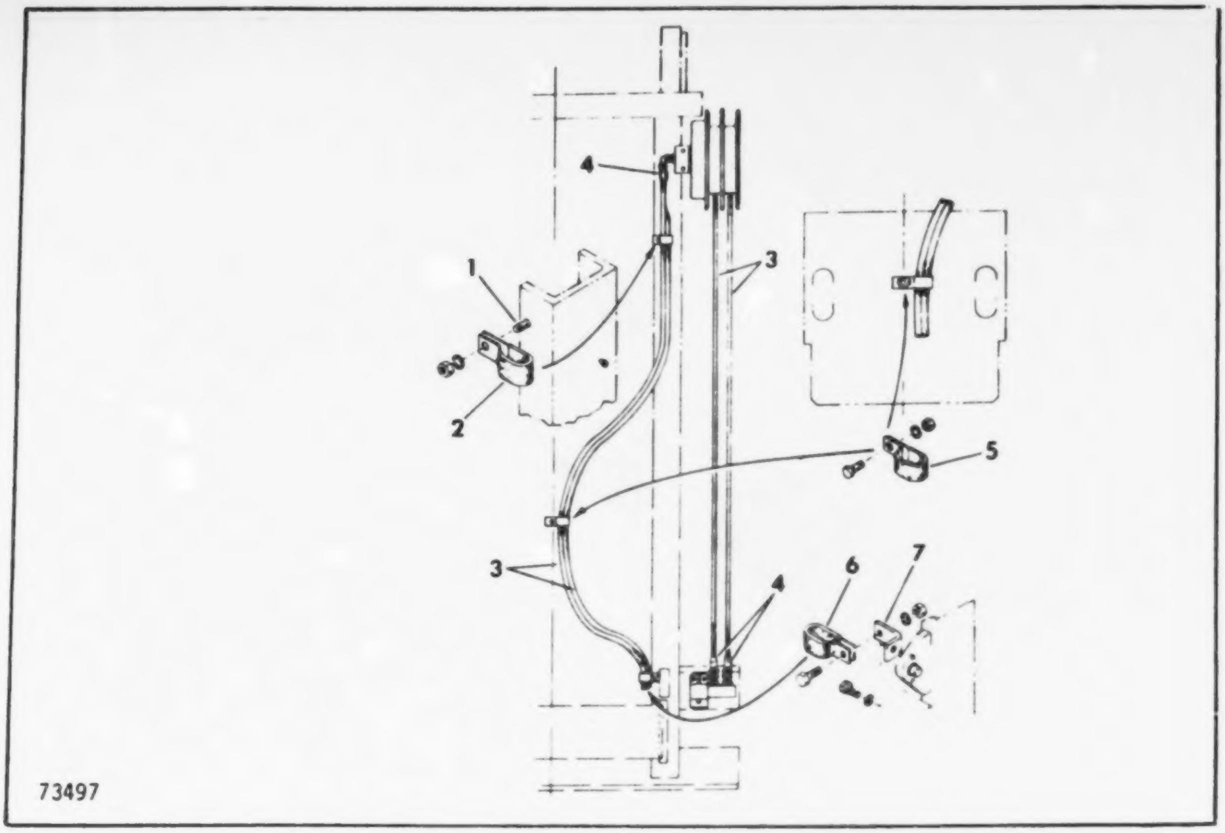
HT-73498

JUNCTION BLOCK- 4844690-0

ITEM	PART NO.	DESCRIPTION	QTY.
1	C-7194	RING-SNAP	1
2	C-604032	SHAFT	1
3	C648569	*RING-BACK-UP	2
4	C2715	*O-RING	3
5	C-646036	BODY	1

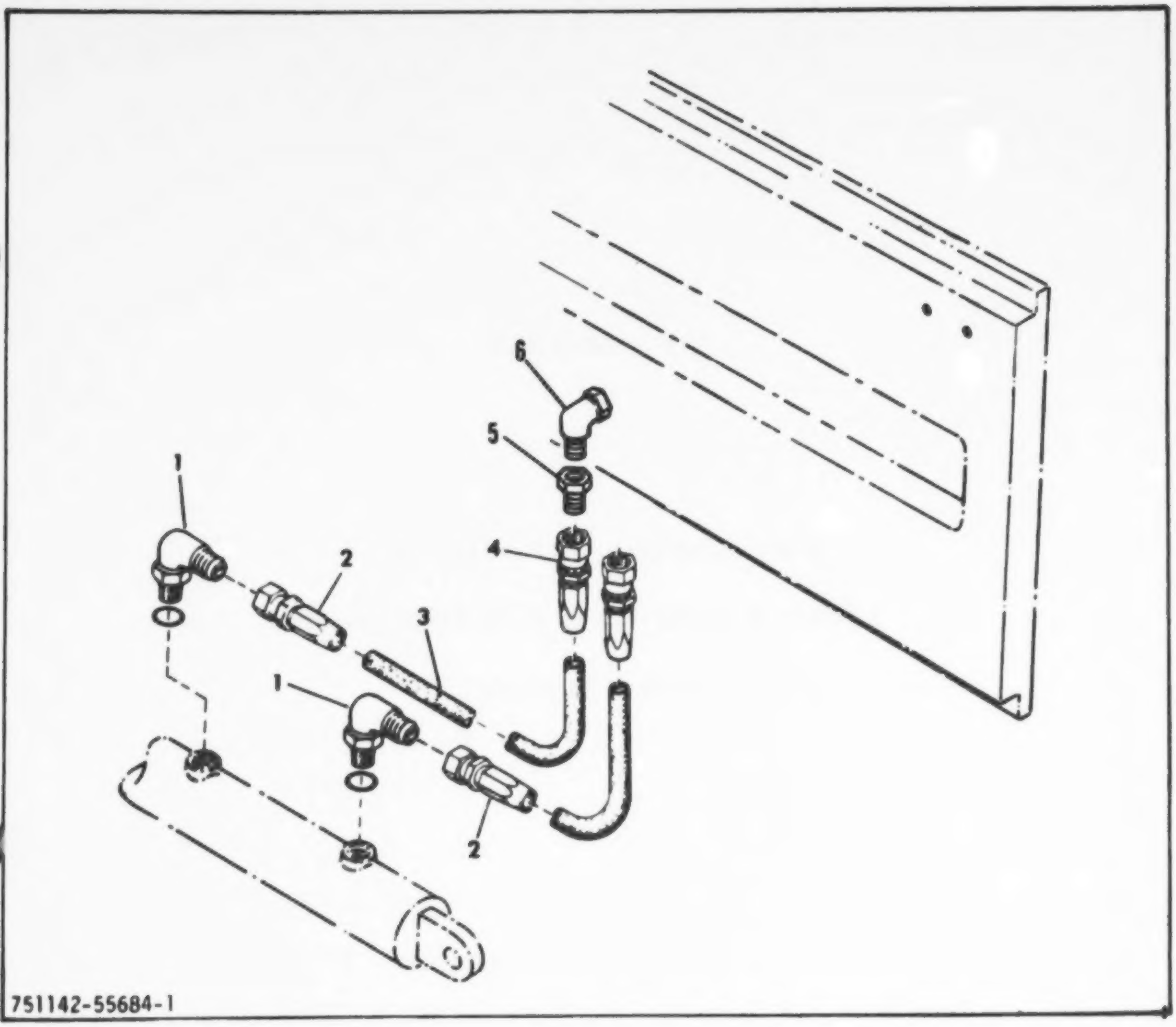
*INCLUDED IN KIT C646339

NOTE: ORDER COMPONENT PARTS FROM CASCADE (02614)



HOSE GROUP

ITEM	PART NO.	DESCRIPTION	QTY.	
1	4255126-7	STUD	1	WELDED TO MAST
2	4714624-6	CLAMP	1	
	0919386-3	WASHER-.47" X 1" X 10 GA	1	
	0917356-8	LOCKWASHER-.31"	3	
	0917372-5	NUT-.31"-18	1	
3	4809161-5	HOSE-.41" ID-20 FT	4	
4	0925984-7	COUPLING-HOSE END	8	
5	4714624-6	CLAMP-DOUBLE	1	
	0921977-5	CAPSCREW-.31"-18 X 1.25"	1	
	0917356-8	LOCKWASHER-.31"	1	
	0917372-5	NUT-.31"-18	1	
6	4714624-6	CLAMP-DOUBLE	1	
	0921332-3	CAPSCREW-.31"-18 X .75"	1	
	0917356-8	LOCKWASHER-.31"	1	
	0917372-5	NUT-.31"-18	1	
7	4714907-5	BRACKET	1	
	0921333-1	CAPSCREW-.31"-18 X 1"	4	
	0917356-8	LOCKWASHER-.31"	2	



751142-55684-1

HYDRAULIC ADAPTION

ITEM	PART NO.	DESCRIPTION	QTY.	
1	0922571-5	ELBOW-90" ADJ-.25" TUBE X .44"-20	2	INCL O-RING
	0921883-5	O-RING-#-904-.351" ID	2	SAE TYPE 1
2	0925805-4	COUPLING-HOSE END-.25" ID X .44"-20	2	
3	4813026-4	HOSE-.25" ID X 3 FT	1	CUT TO LENGTH
4	0926058-9	COUPLING-HOSE END.-125" ID X .44"-20	2	
5	0924457-7	REDUCER-.38 X .25	2	
6	0923905-4	ELBOW-90°-.56-18	2	

SECTION V

SUPPLEMENTAL OPERATIONS, MAINTENANCE AND REPAIR PARTS INSTRUCTIONS

# SUPPLEMENTAL OPERATING, MAINTENANCE AND REPAIR PARTS INSTRUCTIONS
FOR
TRUCK, LIFT, FORK, SOLID RUBBER TIRE GASOLINE ENGINE DRIVEN, 4,000 LB., 144 INCH LIFT, ALLIS CHALMERS MODEL ACC45PS
NSN 3930-01-075-4937
MHE 239

SECTION I - GENERAL

		Page
1.1	Purpose	1
1.2	Scope	1
1.3	Description	1
1.4	Operational Concept	2
1.5	Procurement Status	2
1.6	Equipment Publications	2
1.7	Personnel and Training	3
1.8	Logistics Assistance	4
1.9	Warranty	4
1.10	Reporting (Recommending Publication Changes)	4

SECTION II - MAINTENANCE

2.1	Maintenance Concept Maintenance Allocation Chart (MAC) Maintenance Expenditure Limits (MEL)	4
2.2	Reliability and Maintainability (RAM)	5
2.3	Modifications	5
2.4	Equipment Improvement Recommendations (EIR)	6
2.5	Equipment Serviceability Criteria (ESC)	6
2.6	Shipment and Storage	6
2.7	Destruction to Deny Enemy Use	6

SECTION II Page

2.8 Basic Issue Items List (BIIL) 6
2.9 Special Tools and Equipment 7
2.10 Maintenance and Operating Supplies 7
2.11 Maintenance Forms and Records 7
2.12 Maintenance of New Vehicle 7
2.13 Maintenance Check List (Daily & Periodic) 7

SECTION III - REPAIR PARTS SUPPLY

3.1 General 7
3.2 Prescribed Load List (PLL) 8
3.3 Authorized Stockage List (ASL) 9
3.4 Requisitioning Repair Parts 9
3.5 Submitting Requisitions 10

APPENDIX

A - Special Notes and Corrections 12
B - Warranty 14
C - MAC 15
D - MEL Chart 30
E - MAOSL 31
F - Maintenance of New Vehicle 33
G - Preventive Maintenance Checks and Services 35
H - ASL/PLL 46
I - Distribution Codes 48
J - Flow of Requisitions & Materiel Parts, NSN 51
K - Flow of Requisitions & Materiel Parts, Non NSN 52
L - Sample Requisitioning Formats 53

SECTION I - GENERAL

1.1 PURPOSE: To provide the user and support personnel supplemental maintenance and repair parts instructions applicable to the 4,000 Lb. Allis Chalmers Model ACC45PS Forklift Truck.

1.2 SCOPE: This SOMARPI applies to Department of the Army Units, Organizations and Activities that use and/or support the Truck, Lift, Fork, 4,000 Lb., Solid Rubber Tire, 144 Inches Lift Height, NSN 3930-01-075-4937.

1.3 DESCRIPTION: The 4,000 Lb., Gasoline Engine Driven, Solid Rubber Tire Forklift Truck is manufactured by Allis Chalmers Corporation, Matteson, Illinois. The truck is a front drive, rear steer vehicle with a lift height of 144 inches. It has a constant mesh power shift transmission. The truck is equipped with hydraulic brakes on both drive wheels and a parking brake is mounted on the differential. It has a roller type lift assembly with two independent lift chains. A control valve to operate the hydraulic lift and tilt cylinders is located to the right of the operator. A side shift capability is also present on the vehicle. The instrument panel includes: a gas gauge, oil pressure gauge, ammeter and a direct reading engine hourmeter. The vehicle has a 12 volt electrical system consisting of a heavy duty alternator, voltage regulator and starting motor. The truck is equipped with power steering. The truck has a four cylinder Continental Engine.

1.4 OPERATIONAL CONCEPT: The 4,000 Lb. Allis Chalmers Model ACC45PS is intended to be used for stacking, unstacking and moving cargo in and around warehouses, loading platforms and docks within the military supply system; also, for moving cargo in and out of highway trailers and railroad cars. Trucks are intended for operation over paved, semi prepared and other hard surfaces for short distances.

1.5 PROCUREMENT STATUS: The procurement contract number is DLA-700-78-C-8339.

1.6 EQUIPMENT PUBLICATIONS:

a. Equipment publications initially will be the end item manufacturer's commercial manual.

1.7 PERSONNEL AND TRAINING

a. MOS Requirements: Qualitative and Quantitative Personnel Requirements Information (QQPRI) will be disseminated IAW AR 611-1. The following MOS's can operate and maintain the end item.

(1) Operator: 62F

(2) Organizational Maintenance: 63B & 63G

(3) Direct & General Support Maintenance: 63B, 63G & 63H

b. Training:

(1) New Equipment Training Team (NETT): New Equipment Training Teams are available to major field commands. Request for NETT's should be forwarded to: Commander, US Army Tank-Automotive Command, ATTN: DRSTA-MLT, Warren, MI 48090. Training teams should be requested only when trained personnel are not available in the Command to operate and/or maintain the truck.

(2) New Materiel Introductory Teams (NMIT): Major field commands requiring briefings to Command Staff and Users should forward their requests to Commander, US Army Tank-Automotive Command, ATTN: DRSTA-MLT, Warren, MI 48090. Receiving commands are responsible for the itinerary of NMIT's.

1.8 LOGISTICS ASSISTANCE (AR 700-4): US Army Tank-Automotive Materiel Readiness Command's Field Maintenance Technicians stationed at CONUS and OCONUS installations are available to furnish on-site training and/or technical assistance. Assistance can be obtained by contacting the appropriate Logistics Assistance Office (LAO) listed in Appendix B, AR 700-4.

1.9 WARRANTY: See Appendix B.

1.10 RECOMMENDING PUBLICATION CHANGES: You can improve this publication by recommending improvements, using DA Form 2028 (Recommended Changes to Publications and Blank Forms) and mail direct to the Commander, US Army Tank-Automotive Command, ATTN: DRSTA-MVM, Warren, MI 48090.

SECTION II - MAINTENANCE

2.1 MAINTENANCE CONCEPT:

a. The 4,000 Lb. Allis Chalmers Model ACC45PS will not require special or new maintenance considerations. Maintenance operations can be accomplished within the current maintenance support concept for Material Handling Equipment.

b. Nature and Extent of Maintenance:

(1) Maintenance Allocation Chart (MAC): Maintenance will be performed as necessary by the category indicated in the MAC (Appendix C) to retain and/or restore serviceability. Units may exceed their authorized scope and function in the MAC when approved by the appropriate commander.

(2) Operator Maintenance: Operator maintenance is limited to daily preventive maintenance checks and routine servicing (See Appendix F and/or G).

(3) Organizational Maintenance: Organizational maintenance consists of scheduled preventive maintenance services, limited removal, minor repair and adjustments (See Appendix F and/or G).

(4) Direct Support Maintenance: Direct Support Maintenance consists of repairs on-site and for return to the user of the end item/assemblies which can be maintained efficiently with a minimum of tools and test equipment.

(5) General Support Maintenance: General Support will overhaul and repair for return to stock items designated by the area support commander.

(6) Depot Maintenance: There is no scheduled depot maintenance on the 4,000 Lb. Allis Chalmers Model ACC45PS.

c. Maintenance Expenditure Limit: The Maintenance Expenditure Limit is based on a life expectancy of 11 years. Limits on repair are based upon 65% acquisition cost through the life expectancy of the end item (See Appendix D).

2.2 RELIABILITY & MAINTAINABILITY: Reliability & Maintainability will be assessed through the field evaluation of current users. Specific numerical RAM requirements or objectives are not established.

2.3 MODIFICATIONS: Modifications will be accomplished by the end item manufacturer after MERADCOM acceptance and TARCOM approval.

2.4 EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR): Equipment Improvement Recommendations will be submitted IAW TM 38-750.

2.5 EQUIPMENT SERVICEABILITY CRITERIA (ESC): Equipment Serviceability Criteria are not applicable to the 4,000 Lb. Allis Chalmers Model ACC45PS (AR 750-1).

2.6 SHIPMENT AND STORAGE:

a. Shipment & Storage: Refer to TB 740-94-2 for procedures covering preservation of equipment for shipment. General procedures for shipment are found in FM 55-15, with more specific information in TM 55-2200-001-12 for rail and TM 55-450 series for air transport.

b. Administrative Storage: Refer to TM 740-90-1 for instructions covering administrative storage of equipment.

c. Weight Classification: The weight classification of the end item is 7,600 Lbs.

2.7 DESTRUCTION TO DENY ENEMY USE: Refer to TM 750-244-3 for instructions governing destruction of equipment to prevent enemy use.

2.8 BASIC ISSUE ITEMS LIST (BIIL): Basic Issue Items are as listed:

SMR CODE	NATIONAL STOCK NUMBER	DESCRIPTION REF NO. AND MFG CODE	DESCRIPTION USABLE ON CODE	UNIT OF MEASURE	QTY AUTH
	*7520-00-559-9618	Case, Cotton Duck: MIL-B-11743 (81349)		ea	1
	*7510-00-889-3494	Log Book Binder: MIL-B-43064		ea	1
	*NOTE: Both will be replaced in later models by: 7530-01-065-0166	Equipment Record Folder		ea	1

2.9 SPECIAL TOOLS AND EQUIPMENT: Special tools and equipment are not required for the 4,000 Lb. Allis Chalmers Model ACC45PS.

2.10 MAINTENANCE AND OPERATING SUPPLY LIST: See Appendix E for a list of maintenance and operating supplies required for initial operation.

2.11 MAINTENANCE FORMS AND RECORDS: Operational, maintenance and historical forms/records will be IAW the current TM 38-750.

2.12 MAINTENANCE OF NEW VEHICLE: Your Allis Chalmers Model ACC45PS is generally shipped with the fuel tank drained, the cooling system filled with antifreeze, the crankcase filled with a preservative oil, and the truck completely lubricated. Shipping instructions may vary so it is imperative that certain checks be performed before placing the forklift truck in service (See Appendix F).

NOTE: INSPECTION UPON DELIVERY: For your protection, make a thorough inspection of the vehicle immediately upon delivery. Notify the transit agent and have delivering carrier make a notation on the freight Bill of Lading AT ONCE.

2.13 MAINTENANCE CHECK LIST (DAILY & PERIODIC): See Appendix G.

SECTION III - REPAIR PARTS SUPPLY

3.1 GENERAL:

a. The basic policies and procedures in AR 710-2 and AR 725-50 are generally applicable to repair parts management for Material Handling Equipment (MHE) items.

b. Manufacturer's parts manuals are furnished with MHE items instead of Department of the Army Repair Parts and Special Tool List (RPSTL).

c. National Stock Numbers (NSNs) are initially assigned only to PLL/ASL parts and major assemblies; i.e., engines, transmissions, etc. Additional NSNs are assigned by the supply support activities as demands warrant.

d. Automated Processing (AUTODIN) of Federal Supply Code Manufacturer (FSCM) part number requisitions, without edit for matching NSNs, is authorized.

e. Weapon System Designator Codes on part requisitions are not required.

f. Repair parts are available from commercial sources for CONUS units and may be purchased locally IAW AR 710-2 and AR 735-110.

g. Initial Prescribed Load List (PLL) and Authorized Stockage List (ASL) will be distributed by the Tank-Automotive Materiel Readiness Command (TARCOM), DRSTA-FHM.

3.2 PRESCRIBED LOAD LIST (PLL): The PLL, distributed by TARCOM, is an estimated 15 days supply recommended for initial stockage at organizational maintenance. Management of PLL items will be governed by the provisions of AR 710-2 and local command procedures. A prepared list of PLL parts will be provided to OCONUS units before shipment of the end item. Selection of

PLL parts for shipment to OCONUS units is based upon the receiving command's recommendations after their review of the TARCOM prepared list. Organizations and activities in CONUS will establish PLL stocks through normal requisitioning process (Appendix H). NOTE: Local purchase of repair parts is authorized IAW AR 710-2 and AR 735-110.

3.3 AUTHORIZED STOCKAGE LIST (ASL): The ASL, distributed by TARCOM, is an estimated 45 days supply of repair parts for support units and activities. An initial list of ASL parts will be provided to designated support units (OCONUS) before shipment of the end items. The parts shipped will be selected according to the recommendations of the receiving commands. Receiving commands will make their recommendations after review of the initial list distributed by TARCOM. Support units and activities in CONUS will establish ASL stocks through the normal requisitioning process (See Appendix H). NOTE: Local purchase of repair parts is authorized IAW AR 710-2 and AR 735-110.

3.4 REQUISITIONING REPAIR PARTS (MILSTRIP):

a. All MILSTRIP requisitions (DD Form 1348 series) prepared for repair parts support of MHE items will include the use of certain distribution and project codes.

b. Distribution Codes: (See Appendix I). The distribution code consists of a two part field. The first part (card column 54) designates the control activity that should receive supply and shipping status of all requisitions. The second part (card column 55-56) identifies the end item by the use of a Weapons System Designator Code.

(1) CONUS customers will use code "F" in card column 54. OCONUS customers will use the appropriate code from Appendix P, paragraph P-3, AR 725-50. (See Appendix I).

(2) The Weapons System Designator Code for the 4,000 Lb. Allis Chalmers Model ACC45PS is not applicable. Card Columns 55 & 56 will be left blank on all requisitions for parts to support the designated end item.

c. Project Codes: Direct Support System (DSS) Project Codes (FM 38-725) are no longer mandatory and are being phased out. However, CONUS and OCONUS customers, submitting non-NSN part number requisitions to the Defense Construction Supply Center (DCSC - Routing Identifier Code - "S9C"), will use MHE project codes "JZM" (OCONUS) and "BGX" (CONUS) in card columns 57-59.

3.5 SUBMITTING REQUISITIONS: Requisitions for NSN parts will be forwarded through the Defense Automated Addressing System (DAAS) to the Managing Supply Support Activity (See Appendix J). Requisitions for non-NSN parts will be forwarded through DAAS to the Defense Construction Supply Center (DCSC) (See Appendix K).

Sample formats for requisitioning are found in Appendix L. NOTE: When the manufacturer's part number and federal supply code for manufacturer (FSCM) exceed the space in card columns 8 through 22 of A02/A0B requisitions, prepare an A05/A0E requisition (DD Form 1348-6) and mail it to: Commander, Defense Construction Supply Center, ATTN: DCSC-OSR, Columbus, Ohio 43215.

APPENDIX A

SPECIAL NOTES AND CORRECTIONS

PLEASE CHECK YOUR MANUAL (TM-00-1311) AND ENTER THESE LATEST PART NUMBER CHANGES

A.C. Part No.	TM-00-1311 Page	Item	FSCM	Vendor Part No.	Nomenclature
	171		02614	C646340	Kit, Block
4876466-7	65		16764	771-4-2500	Hourmeter
4892777-6	1		02978	F163854	Engine, Assy
4912471-2	117		96151	64009	Kit, Seal, Steering
4912483-9	117		96151	64418	Kit, Bearing, Steering

THIS PAGE

INTENTIONALLY

LEFT

BLANK

APPENDIX B

Warranty Guidelines

1. The warranty period is fifteen months from date of acceptance or 1500 hours of operation, whichever occurs first. Further, if the Government, prior to placing vehicles in service, elects to place quantities of such newly delivered vehicles in Government depot storage, the warranty period on these vehicles, which are stored, will not begin to run until each vehicle is withdrawn from Government storage or until six months from date of acceptance, whichever occurs first. The warranty applies to all supplies furnished under the contract (NOTE: Date of acceptance is on data plate).

2. The manufacturer's warranty is described in the service manuals (on back of front cover, TM-00-1311): "When a warranty circumstance arises, contact Allis-Chalmers Service Administration (312/747-5151, extension 377), informing model, serial number, contract number relating to the particular unit and a summary as to the nature of the problem." Copies of the manual are overpacked with each vehicle.

3. If Allis-Chalmers/Service Agency is not available, CONUS units notify the National Maintenance Point (NMP) by telephone, AUTOVON 369-2525/2686. Units, OCONUS, follow warranty reporting procedures in TM 38-750.

4. All Warranty Claims, whether they are settled locally with a manufacturer's representative or processed through normal Army Maintenance Support Channels, must be reported to: US Army Tank-Automotive Command, ATTN: DRSTA-MVM.

APPENDIX C

Maintenance Allocation Chart
For
Truck, Forklift, GED, SRT, 4,000 Lb.
Capacity, Allis Chalmers Model ACC45PS
NSN 3930-01-075-4937
MHE 239

Section I - Introduction

1. General: This Maintenance Allocation Chart (MAC) designates responsibility for performance of maintenance functions to specific maintenance categories.

2. Maintenance Functions: Maintenance functions are as follows:

a. Inspect: To determine the serviceability of an item by comparing its physical, mechanical and/or electrical characteristics with established standards through examination.

b. Test: To verify serviceability and detect incipient failures by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. Service: Operations required periodically to keep an item in proper operating condition; i.e., to clean (decontaminate), to preserve, to drain, to paint or to replenish fuel, lubricants, hydraulic fluids or compressed air supplies.

d. Adjust: To maintain, within prescribed limits, by bringing into proper or exact position or by setting the operating characteristic to specified parameters.

e. Align: To adjust specified variable elements of an item to bring about optimum or desired performance.

best copy available

Reproduced from poor document.

f. Calibrate: To determine and cause corrections to be made or to be adjusted on instruments or test measuring and diagnostic equipment used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. Install: The act of emplacing, seating or fixing into position an item, part or module (component or assembly) in a manner to allow the proper functioning of an equipment or system.

h. Replace: The act of substituting a serviceable like type part, subassembly or module (component or assembly) for an unserviceable counterpart.

i. Repair: The application of maintenance services or other maintenance actions to restore serviceability to an item by correcting specific damage, fault, malfunction or failure in a part, subassembly, module (component or assembly), end item or system.

j. Overhaul: That maintenance effort (service/action) necessary to restore an item to a completely serviceable/operational condition as prescribed by maintenance standards (i.e., DMWR) in appropriate technical publications. Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

k. Rebuild: Consists of those services/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of materiel maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours/miles, etc.) considered in classifying Army equipment/components.

3. Column Entries: Columns used in the MAC are explained below:

a. Column 1 - Group Number: Column One (1) lists group numbers from TB 750-93-1, the purpose of which is to identify components, assemblies, subassemblies and modules with their next higher assemblies.

b. Column 2 - Component/Assembly: Column Two (2) contains the noun names of components, assemblies, subassemblies and modules for which maintenance is authorized.

c. Column 3 - Maintenance Functions: Column Three (3) lists the functions to be performed on the item listed in Column 2.

d. Column 4 - Maintenance Category: Column Four (4) specifies, by the listing of a "work time" figure in the appropriate sub column(s), the lowest level of maintenance authorized to perform the function listed in Column 3. This numeric figure represents the active time required to perform that maintenance function at the indicated category of maintenance. The number of man hours specified by the "work time" figure represents the average time required to restore an item (assembly, subassembly, component, module, end item or system) to a serviceable condition under typical field operating conditions. This time includes preparation time, troubleshooting time and quality assurance/quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the MAC.

e. Column 5 - Tools and Equipment: Column Five (5) specifies by code, those common tool sets (not individual tools) and special tools, test and support equipment required to perform the designated function.

SECTION II - ASSIGNMENT OF MAINTENANCE FUNCTIONS

(1)	(2)	(3)	(4)					(5)	(6)
GROUP NUMBER	COMPONENT/ASSEMBLY	MAINTENANCE FUNCTION	MAINTENANCE CATEGORY					TOOLS AND EQUIP.	REMARKS
			C	O	F	H	D		
01	Engine								
0100	Engine Assembly	Service Replace Repair Overhaul	0.4		 4.0	 8.0 20.0		 1 - 12 1 - 12 1 - 12	
0101	Block, Short Assembly	Replace Repair				8.0 16.0		1 - 12 1 - 12	
	Cylinder Head	Replace Repair			2.0	 3.0		1 - 12 1 - 12	
0102	Crankshaft	Replace Repair				6.0 8.0		1 - 12 1 - 12	
	Gear, Crankshaft	Replace			4.5			1 - 12	
	Gear, Hydraulic	Replace			4.0			1 - 12	
0103	Flywheel Assembly	Replace Repair			4.0 8.0			1 - 12 1 - 12	
	Gear, Ring	Replace			4.0			1 - 12	
0104	Piston, Connecting Rods	Replace				4.2		1 - 12	
0105	Valves (Exhaust & Intake)	Adjust Replace		1.5	 3.5			1 - 4 1 - 12	
	Camshaft	Replace			6.0			1 - 12	
	Gears & Cover	Replace			4.0			1 - 12	
0106	Oil Pump	Replace Repair			3.0	 2.0		1 - 12 1 - 12	
	Oil Filter	Replace		0.5				1 - 4	
	Oil Pan	Replace			1.5			1 - 12	
0108	Manifold	Replace		0.7				1 - 4	

MAINTENANCE ALLOCATION CHART

SECTION II - ASSIGNMENT OF MAINTENANCE FUNCTIONS

(1)	(2)	(3)	(4)					(5)	(6)
GROUP NUMBER	COMPONENT/ASSEMBLY	MAINTENANCE FUNCTION	MAINTENANCE CATEGORY					TOOLS AND EQUIP.	REMARKS
			C	O	F	H	D		
03	Fuel System								
0301	Carburetor	Adjust		0.3				1 - 4	
		Replace		0.5				1 - 4	
		Repair			2.0			1 - 12	
0302	Fuel Pump	Test		0.3				1 - 4	
		Replace		0.5				1 - 4	
	Lines, Fittings & Hoses	Replace		0.7				1 - 4	
0304	Air Cleaner & Indicator	Service		0.2				1 - 4	
		Replace		0.3				1 - 4	
0306	Fuel Tank	Service	0.2						
		Replace			1.0			1 - 12	
	Fuel Lines & Fittings	Replace		0.5				1 - 4	
0308	Governor	Replace		0.4				1 - 4	
		Repair			1.0			1 - 12	
0309	Filter Fuel	Replace		0.2				1 - 4	
0312	Accelerator, Throttle Controls	Replace		1.5				1 - 4	
04	Exhaust System								
0401	Muffler	Replace		0.6				1 - 4	
	Exhaust Pipe	Replace		0.8				1 - 4	
05	Cooling System								
0501	Radiator	Service	0.2	0.3				1 - 4	
		Replace		1.2				1 - 4	
		Repair			2.5			1 - 12	
0503	Thermostat	Test		0.5				1 - 4	
		Replace		0.5				1 - 4	
	Hoses, Upper & Lower	Replace		0.6				1 - 4	
0504	Water Pump Assembly	Replace		0.5				1 - 4	
		Overhaul			1.5			1 - 12	

SECTION II - ASSIGNMENT OF MAINTENANCE FUNCTIONS

(1)	(2)	(3)	(4)					(5)	(6)
GROUP NUMBER	COMPONENT/ASSEMBLY	MAINTENANCE FUNCTION	MAINTENANCE CATEGORY					TOOLS AND EQUIP.	REMARKS
			C	O	F	H	D		
0505	Fan, Assembly	Replace		0.4				1 - 4	
	Fan Belt	Replace		0.3				1 - 4	
06	Electrical System								
0601	Alternator	Test		0.2				1 - 4	
		Replace		0.5				1 - 4	
		Repair			1.5			1 - 12	
	Regulator	Replace			1.0			1 - 12	
0603	Starter Motor	Test		0.3				1 - 4	
		Replace		0.5				1 - 4	
		Repair			2.5			1 - 12	
	Switch, Starter Ignition	Replace		0.4				1 - 4	
0605	Distributor Assembly	Adjust		0.3				1 - 4	
		Replace		0.5				1 - 4	
	Ignition Coil	Replace		0.3				1 - 4	
	Wiring	Replace		0.2				1 - 4	
	Spark Plugs	Adjust		0.2				1 - 4	
		Replace		0.3				1 - 4	
0607	Instruments, Panel	Replace		1.0				1 - 4	
		Repair			1.4			1 - 12	
	Hourmeter	Replace		0.3				1 - 4	
	Ammeter	Replace		0.3				1 - 4	
	Gauge, Oil Pressure	Replace		0.4				1 - 4	
	Gauge, Engine Temp.	Replace		0.3				1 - 4	
	Gauge, Fuel	Replace		0.3				1 - 4	
0608	Switch, Light	Replace		0.2				1 - 4	
	Box, Fuse	Replace		0.3				1 - 4	

MAINTENANCE ALLOCATION CHART

SECTION II - ASSIGNMENT OF MAINTENANCE FUNCTIONS

(1)	(2)	(3)	(4)					(5)	(6)
GROUP NUMBER	COMPONENT/ASSEMBLY	MAINTENANCE FUNCTION	MAINTENANCE CATEGORY					TOOLS AND EQUIP.	REMARKS
			C	O	F	H	D		
0609	Lights, Headlights & Taillights	Replace		0.3				1 - 4	
0610	Sending Unit (Fuel, Oil & Temp)	Replace		0.4				1 - 4	
0611	Horn, Relay & Wiring	Test		0.1				1 - 4	
		Replace		0.3				1 - 4	
0612	Battery	Service	0.2						
		Test		0.2				1 - 4	
		Replace		0.5				1 - 4	
		DX			1.0			1 - 12	
07	Transmission								
0710	Transmission Assembly	Service	0.5	0.7				1 - 4	
		Test			1.0			1 - 12	
		Replace			6.0			1 - 12	
		Repair				8.0		1 - 12	
		Overhaul				16.0		1 - 12	
	Transmission Shafts & Gears	Replace				4.0		1 - 12	
0708	Torque Converter & Drive Plate	Replace			1.0			1 - 12	
0713	Transmission Clutch Forward & Reverse	Replace				4.0		1 - 12	
		Overhaul				6.0		1 - 12	
0714	Transmission Control Valve	Replace				1.5		1 - 12	
		Repair				3.5		1 - 12	
0714	Transmission Shift Levers & Linkage	Adjust		0.3				1 - 4	
		Replace		0.5				1 - 4	
0721	Oil Filter, Transmission	Replace		0.4				1 - 4	
09	Propeller Shaft								
0900	Propeller Shaft	Service	.2						
		Replace			0.8			1 - 12	
		Repair			1.5			1 - 12	

SECTION II - ASSIGNMENT OF MAINTENANCE FUNCTIONS

(1)	(2)	(3)	(4)					(5)	(6)
GROUP NUMBER	COMPONENT/ASSEMBLY	MAINTENANCE FUNCTION	MAINTENANCE CATEGORY					TOOLS AND EQUIP.	REMARKS
			C	O	F	H	D		
10	Front Axle (Drive)								
1000	Front Axle Assembly	Service		0.5				1 - 4	
		Replace				4.0		1 - 12	
		Repair				8.0		1 - 12	
	Spindle, Axle	Replace			0.7			1 - 12	
	Axle Shaft	Replace			1.0			1 - 12	
	Bearings & Seals Axle Shaft	Replace				0.5		1 - 12	
1002	Differential Carrier	Replace			2.0			1 - 12	
		Repair			6.0			1 - 12	
	Differential Assembly	Replace			1.5			1 - 12	
		Repair			4.0			1 - 12	
1002	Ring Gear & Pinion	Replace			1.0			1 - 12	
	Pinion Seal & Bearings	Replace			0.5			1 - 12	
11	Rear Axle (Steering)								
1100	Rear Axle Assembly	Service		0.5				1 - 4	
		Replace			4.0			1 - 12	
		Repair			6.0			1 - 12	
		Adjust		0.8				1 - 4	
	Spindle, Right or Left	Service		0.3				1 - 4	
		Replace			1.5			1 - 12	
	Axle King Pin & Needle Bearings	Service		0.3				1 - 4	
		Replace			1.5			1 - 12	
	Pivot Arm & Bearings	Service		0.3				1 - 4	
		Replace			1.5			1 - 12	
	Axle Mounting, Trunnion Bearings & Housing	Service		0.5				1 - 4	
		Replace			2.0			1 - 12	
	Tie Rods, Right & Left	Adjust		0.4				1 - 4	
		Replace			1.5			1 - 12	
		Service		0.3				1 - 4	

MAINTENANCE ALLOCATION CHART

SECTION II - ASSIGNMENT OF MAINTENANCE FUNCTIONS

(1)	(2)	(3)	(4)					(5)	(6)
GROUP NUMBER	COMPONENT/ASSEMBLY	MAINTENANCE FUNCTION	MAINTENANCE CATEGORY					TOOLS AND EQUIP.	REMARKS
			C	O	F	H	D		
12	Brakes								
1201	Hand Brakes, Lever & Linkage	Adjust		0.4				1 - 4	
		Service		0.3				1 - 4	
		Replace			1.5			1 - 12	
	Parking Brake	Replace			1.0			1 - 12	
		Repair			1.5			1 - 12	
1202	Service Brake	Service		0.4				1 - 4	
		Replace			4.0			1 - 12	
		Repair			6.0			1 - 12	
1204	Hydraulic Brake System	Service		0.3				1 - 4	
	Master Cylinder	Replace		1.0				1 - 4	
		Repair			1.6			1 - 12	
	Wheel Cylinder	Replace			2.0			1 - 12	
		Repair			2.5			1 - 12	
1206	Brake Pedal & Linkage	Replace		0.6				1 - 4	
		Repair		0.8				1 - 4	
13	Wheels								
1311	Wheel Assembly	Replace		1.5				1 - 4	
	Bull Gear	Replace		1.0				1 - 4	
	Bearings & Seals	Replace		1.0				1 - 4	
1313	Tires, Solid Rubber	Inspect	0.2						
		Replace				1.7		1 - 12	
14	Steering								
1407	Steering Wheel	Replace		0.5				1 - 4	
	Steering Column & Shaft	Replace			1.5			1 - 12	
	Steering Cylinder	Service		0.3				1 - 4	
		Replace			1.5			1 - 12	
		Repair			2.5			1 - 12	

SECTION II - ASSIGNMENT OF MAINTENANCE FUNCTIONS

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQUIP.	(6) REMARKS
1411	Hoses, Lines & Fittings	Replace			0.5			1 - 12	
		Repair			0.3			1 - 12	
	Hydraulic Filter Assembly	Replace		0.3				1 - 4	
	Hydraulic Filter Element	Replace		0.3				1 - 4	
1412	Hydraulic Cylinder	Replace		1.2				1 - 4	
		Repair			2.0			1 - 12	
1414	Steering Control Valve	Replace			1.0			1 - 12	
18	Body, Cab, Hood & Hull								
1801	Overhead Guard	Replace		0.5				1 - 4	
		Repair			1.0			1 - 12	
	Body Panel & Hoods	Replace		0.3				1 - 4	
		Repair			0.5			1 - 12	
1806	Seat Cushions, Adjuster & Slide	Adjust	0.2						
		Replace		0.5				1 - 4	
		Repair			0.7			1 - 12	
24	Hydraulic Lift Compartment								
2401	Hydraulic Pump	Test			0.2			1 - 12	
		Replace			.7			1 - 12	
		Repair				2.0		1 - 12	
2402	Hydraulic Control Valve	Replace			1.0			1 - 12	
		Repair			2.0			1 - 12	
2403	Hydraulic Control Levers & Linkage	Replace		0.5				1 - 4	
		Repair			1.0			1 - 12	
2404	Hydraulic Tilt Cylinder	Replace			0.5			1 - 12	
		Repair			1.5			1 - 12	
2405	Cluster Cylinder	Replace			1.5			1 - 12	
		Repair				2.5		1 - 12	

MAINTENANCE ALLOCATION CHART

SECTION II - ASSIGNMENT OF MAINTENANCE FUNCTIONS

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY					(5) TOOLS AND EQUIP.	(6) REMARKS
			C	O	F	H	D		
2405	Mast & Carriage Assembly	Service		0.3				1 - 4	
		Adjust		0.3				1 - 4	
		Repair			2.0			1 - 12	
		Replace			1.0			1 - 12	
2406	Hydraulic Lines & Fittings	Replace			1.0			1 - 12	
2407	Side Shift Cylinder	Replace			0.5			1 - 12	
		Repair			1.5			1 - 12	
2408	Oil Reservoir	Service		0.3				1 - 4	
		Replace			2.0			1 - 12	

MAINTENANCE ALLOCATION CHART FOR

(MD SOP 700-5)

SECTION III - TOOL AND TEST EQUIPMENT REQUIREMENTS

UNLESS OTHERWISE NOTED, ALL MAINTENANCE FUNCTIONS CAN BE ACCOMPLISHED WITH THE TOOLS CONTAINED IN THE FOLLOWING COMMON TOOL SETS.

TOOL OR TEST EQUIPMENT REFERENCE CODE	MAINTENANCE CATEGORY	NOMENCLATURE	NATIONAL/NATO STOCK NUMBER	TOOL NUMBER
1.	O,F,H	Tool Kit, General Mechanic Auto; SC-5180-90-CL-N26	5180-00-177-7033	W33004
2.	O,F,H	Shop Equipment, Auto Maint & Repair: Org Maint Common No. 1 - Less Power; SC 4910-95-CL-A74	4910-00-754-0654	W32593
3.	O,F,H	Shop Equipment, Auto Maint & Repair: Org Maint Supplemental No.1 - Less Power; SC 4910-95-CL-A73	4910-00-754-0653	W32867
4.	O,F,H	Shop Equipment, Auto Maint & Repair: Org Common No.2 - Less Power; SC 4910-95-CL-A72	4910-00-754-0650	W32730
5.	F,H	Shop Set, Fuel & Electrical Systems, FM Basic - Less Power; SC 4910-95-CL-A01	4910-00-754-0714	T30414
6.	F,H	Shop Set, Auto Maint & Repair, FM Basic - Less Power; SC 4910-95-CL-A31	4910-00-754-0705	T24660
7.	F,H	Shop Set, Fuel & Electrical System, FM Supplemental No. 1 - Less Power; SC 4910-95-CL-A64	4910-00-390-7774	T30551
8.	F,H	Shop Equipment, Auto Maint & Repair: FM Supplemental No.1 - Less Power; SC 4910-95-CL-A62	4910-00-754-0706	T24519

PREVIOUS EDITIONS OF THIS FORM MAY BE USED

MAINTENANCE ALLOCATION CHART FOR

(MD SOP 700-5)

SECTION III – TOOL AND TEST EQUIPMENT REQUIREMENTS

TOOL OR TEST EQUIPMENT REFERENCE CODE	MAINTENANCE CATEGORY	NOMENCLATURE	NATIONAL/NATO STOCK NUMBER	TOOL NUMBER
9.	F,H	Shop Set, Fuel & Electrical Systems: FM Supplemental No.2 - Less Power: SC 4910-95-CL-A65	4910-00-390-7775	T30688
10.	F,H	Shop Equipment, Welding: FM; SC 3470-90-CL-A08	3470-00-357-7268	T16714
11.	F,H	Tool Kit, Master Mechanics; SC 5180-90-CL-N04	5180-00-699-5273	W45060
12.	F,H	Tool Kit, Welders; SC 5180-90-CL-N39	5180-00-754-0661	W58075

PREVIOUS EDITIONS OF THIS FORM MAY BE USED

SECTION IV. REMARKS

REFERENCE CODES	REMARKS
None	None

APPENDIX D

MAINTENANCE EXPENDITURE LIMITS

FSC or NSN	Item Identification	Serial Number	Production Year	Serial No. Range or USA No.	Years of Life Expectancy	Repair Limitations				
						55%	45%	35%	25%	10%
1	2	3	4	5	6	7	8	9	10	11
3930-01-075-4937	Truck, Lift, Fork, Gasoline Engine Driven; 4,000 LB Capacity, 144" Lift, MHE 239.		1979		11	1982	1984	1986	1988	1991

APPENDIX E

MAINTENANCE AND OPERATING SUPPLY LIST

Nomenclature: TRUCK,LIFT,FORK, 4K,GED,SRT,144"LIFT
Make: ALLIS CHALMERS
Model: ACC45PS
MFR Part No.:
NSN: 3930-01-075-4937
Serial No. Range:
Date: APRIL 1979

COMPONENT APPLICATION	MFR PART NO. OR NAT'L STOCK NO.	DESCRIPTION	QTY REQ F/INIYIAL OPN	QTY REQ F/8 HRS OPN	NOTES
Engine	9150-00-186-6668	OE/HDO-10 (5 gal)	5 qts		SEE ATTACHED SHEET
	9150-00-189-6728	OE/HDO-10 (55 gal)			
	9150-00-188-9858	OE/HDO-30 (5 gal)			
	9150-00-188-9859	OE/HDO-30 (55 gal)			
Fuel Tank	9130-00-264-6218	Bulk: Regular Grade	5 gal	8 gal	
Radiator	6850-00-243-1992	Water Antifreeze (1 gal)	None		
Hydraulic Brake	9150-00-252-6375	HBA	None		
Differential	9150-00-577-5844	GO-90 (5 gal)	None		
	9150-00-577-5847	GO-140 (5 gal)	None		
	9150-00-257-5440	GOS (5 gal)	None		
Transmission	*See Engine	OE/HDO-10	None		
Hydraulic SYS	*See Engine	OE/HDO-10	None		
Lubrication Fittings	9150-00-190-0907	GAA (35 lb. can)	None	AsReq	
Electrolyte	6810-00-249-9354	Sulfuric Acid, Electrolyte	None		

LUBRICANTS	CAPACITY	EXPECTED TEMPERATURES			INTERVALS
		Above 32 F Above 0 C	+40 F to -10 F +5 C to -23 C	0 F to -65 F -18 C to -50C	
OE/HDO OIL,Engine, Heavy Duty		OE/HDO 10	OE/HDO 10	OE/HDO 10	Intervals given in hours of normal operation.
Oil Can Points					
Hydraulic Reservoir	5.9gals(22.3L)				
Engine Crankcase(see note 4)	4qts(3.8L)	OE/HDO 30	OE/HDO 20	OE/HDO 10	
Transmission(see note 5)	11qts(10.4L)	OE/HDO 10	OE/HDO 10	OE/HDO 10	
GO-LUBRICATING OIL, Gear		GO 140	GO 90	GOS	
Drive Axle	5pts(2.3L)				
GOS-LUBRICATING OIL, Gear,Sub-zero					
GAA-GREASE, Automotive and Artillery		ALL TEMPERATURES			
HBA-HYDRAULIC FLUID					
Brake Master Cylinder	3pts(1.4L)				

NOTES:

1. FOR OPERATION OF EQUIPMENT IN PROTRACTED COLD TEMPERATURES BELOW -10 F. Remove lubricants prescribed in the key for temperatures above -10 F. Relubricate with lubricants specified in the key for temperatures below -10 F(-18 C).

2. OIL CAN POINTS. Every 50 hours lubricate the accelerator and parking brake linkage, mast interlock,control valve linkage, pins and clevises and all exposed adjusting threads with OE/HDO.

3. WHEEL BEARINGS AND BULL GEARS. Every 500 hours remove wheels, clean and inspect all parts, replace damaged or worn parts, repack bearings, and then reassemble. Fill bull gear spaces to three-fourths height of teeth with grease GAA.

4. ENGINE CRANKCASE. Add one pint(0.478L) when oil filter is replaced.

5. TRANSMISSION. Add one quart(0.946L) when filter is replaced.

6. LUBRICANTS. The following is a list of lubricants with the Military Symbols and applicable Specification numbers: OE/HDOMIL-L-2104C, GO MIL-L-2105, GOS MIL-L-10324, HBA MIL-H-5606, GAA MIL-G-10924.

IMPORTANT: See also TM-00- 1311,page 2-119.

APPENDIX F

Maintenance of New Vehicle

1. Inspection Upon Delivery: For your protection, make a thorough inspection of the vehicle immediately upon delivery. Notify the transit agent and have the delivering carrier make a notation on the freight Bill of Lading at once.
2. Engine Oil: Check oil level in crankcase. Withdraw dipstick and wipe clean, reinsert the dipstick all the way and then remove it for a true reading. DO NOT CHECK OIL LEVEL WITH ENGINE RUNNING. NOTE: All units are shipped with a preservative oil in the crankcase. This oil should be drained immediately and replaced with the proper oil (See Appendix E).
3. Cooling System: Check coolant level. All vehicles are shipped with coolant to protect to -30°F or lower.
4. Fuel Tank: Ensure vehicle has fuel. Vehicle is protected with protecto-seal cap to guard against fire hazards, theft and tampering.
5. Lubrication: Ensure that vehicle was lubricated prior to shipment. Check all lubrication points as given in TM-00-1311 on page 2-119.
6. Battery: A 12 volt battery is located in a swing out tray below the operator's seat inside the right side panel. Keep cells filled to the bottom of the filler holes with clean distilled water.
7. Power Shift Transmission: Remove floor plate and with the parking brake set and transmission in NEUTRAL, start and run engine for a few minutes until transmission fluid operating temperature is obtained. Stop engine and immediately check transmission fluid level with the dipstick.
8. Differential: With vehicle on a level surface, remove plug from front of axle housing. Oil should be level with lower edge of plug hole.

9. Hydraulic System: With vehicle on level surface, lift cylinder vertical and with lift plunger retracted, turn off the engine and check oil level in the hydraulic reservoir. Oil should be to the level shown on the dipstick. The dipstick is located at the top of the reservoir, inside the right hand panel.

10. Brake Master Cylinders: The brake master cylinder is located under the floor plate on the right side of the truck. It should be filled to 3/8" from bottom of filler neck.

11. Air Cleaner: The air cleaner is mounted inside the engine compartment. It is a dry element type cleaner with replaceable cartridge. Check tightness of all connections.

12. Instruments: Start engine, check to see all gauges are operating properly.

APPENDIX G

PREVENTIVE MAINTENANCE CHECKS AND SERVICES

1. Do your before (B) PREVENTIVE MAINTENANCE just before you operate the vehicle. Pay attention to the CAUTIONS and WARNINGS.

2. DURING checks and services (D) of PREVENTIVE MAINTENANCE will be preformed while the equipment and/or its component systems are in operation.

3. Do your after (A) PREVENTIVE MAINTENANCE right after operating the vehicle. Pay attention to the CAUTIONS and WARNINGS.

4. Do your weekly (W) PREVENTIVE MAINTENANCE weekly.

5. Do your monthly (M) PREVENTIVE MAINTENANCE once a month.

6. If something doesn't work, troubleshoot it with the instructions in your commercial manual, TM-00-1311, page 2-11, or notify your supervisor.

7. Always do your PREVENTIVE MAINTENANCE in the same order so it gets to be a habit. Once you've had some practice, you'll spot anything wrong in a hurry.

8. If anything looks wrong and you can't fix it, write it on your DA Form 2404. If you find something seriously wrong, report it to organizational maintenance IGHT NOW.

9. When you do your PREVENTIVE MAINTENANCE, take along the tools you will need to make all the checks. Take along a rag, you'll always need at least one.

A - Keep it clean: Dirt, grease, oil, and debris only get in the way and may cover up a serious problem. Clean as you work and as needed. Use dry cleaning solvent (SD-2) on all metal surfaces. Use soap and water when you clean rubber or plastic material.

WARNING

> DRY CLEANING SOLVENT, USED TO CLEAN PARTS IS POTENTIALLY DANGEROUS TO PERSONNEL AND PROPERTY. DO NOT USE NEAR OPEN FLAME OR EXCESSIVE HEAT. FLASH POINT OF THIS SOLVENT IS 138^{o}F.

B - Bolts, nuts, and screws: Check them all for obvious looseness, missing, bent or broken condition. You can't try them all with a tool, of course, but look for chipped paint, bare metal, or rust around bolt heads. If you find one you think is loose, tighten it, or report it to organizational maintenance if you can not tighten it.

- Welds: Look for loose or chipped paint, rust, or gaps where parts are welded together. If you find a bad weld, report it to organizational maintenance.

D - Electric wires and connectors: Look for cracked or broken insulation, bare wires, and loose or broken connectors. Tighten loose connectors and make sure the wires are in good shape.

E - Hoses and fluid lines: Look for wear, damage, and leaks, and make sure clamps and fittings are tight. Wet spots show leaks, of course. But a stain around a fitting or connector can mean a leak. If a leak comes from a loose fitting or connector, tighten it. If something is broken or worn out, report it to organizational maintenance.

10. It is necessary for you to know how fluid leakage affects the status of your vehicle. The following are definitions of the types/classes of leakage an operator or crew member needs to know to be able to determine the status of his/her vehicle. Learn, then be familiar with them and REMEMBER - WHEN IN DOUBT, NOTIFY YOUR SUPERVISOR!

Leakage Definitions for Crew/Operator PMCS

Class I	Seepage of fluid (as indicated by wetness or discoloration) not great enough to form drops.
Class II	Leakage of fluid great enough to form drops but not enough to cause drops to drip from item being checked/inspected.
Class III	Leakage of fluid great enough to form drops that fall from the item being checked/inspected.

CAUTION

EQUIPMENT OPERATION IS ALLOWABLE WITH MINOR LEAKAGES (CLASS I OR II). OF COURSE, CONSIDERATION MUST BE GIVEN TO THE FLUID CAPACITY IN THE ITEM/SYSTEM BEING CHECKED/INSPECTED. WHEN IN DOUBT, NOTIFY YOUR SUPERVISOR.

OPERATOR/CREW PREVENTIVE MAINTENANCE CHECKS AND SERVICES

B-BEFORE D-DURING A-AFTER W-WEEKLY M-MONTHLY

ITEM NO	INTERVAL					ITEM TO BE INSPECTED PROCEDURE: CHECK FOR AND HAVE REPAIRED, FILLED OR ADJUSTED AS NEEDED	EQUIPMENT IS NOT READY AVAILABLE IF:
	B	D	A	W	M		
						IMPORTANT: PERFORM WEEKLY AS WELL AS BEFORE OPERATIONS PMCS IF: 1. YOU ARE THE ASSIGNED OPERATOR AND HAVE NOT OPERATED THE ITEM SINCE THE LAST WEEKLY. 2. YOU ARE OPERATING THE ITEM FOR THE FIRST TIME. NOTE: HAVE ORGANIZATIONAL MAINTENANCE. ADJUST ENGINE VALVE CLEARANCE AFTER FIRST 50 HOURS OF OPERATION.	
1	●					EXTERIOR OF VEHICLE	
						a. Check for leaks or appearance of leaks.	Class III leaks or any fuel leak.
						b. Visually check overhead guard for obvious cracks in welds.	Obvious cracks in welds.
2	●					HYDRAULIC RESERVOIR	
						Check reservoir oil level, add oil if necessary to bring level up to full mark on dipstick, when mast is lowered and all cylinders retracted.	
3	●					TIRES	
						Check tires for wear, cracks, gouges & chunking.	Chunking, gouging or wear which would cause unsafe operating conditions.

OPERATOR/CREW PREVENTIVE MAINTENANCE CHECKS AND SERVICES

B-BEFORE D-DURING A-AFTER W-WEEKLY M-MONTHLY

ITEM NO	INTERVAL					ITEM TO BE INSPECTED PROCEDURE: CHECK FOR AND HAVE REPAIRED, FILLED OR ADJUSTED AS NEEDED	EQUIPMENT IS NOT READY. AVAILABLE IF:
	B	D	A	W	M		
4	●					RADIATOR Check radiator to insure that coolant is one inch below bottom of filler tube (add 50/50 mixture of water and antifreeze) (reference TB 750-651).	
5	●					ENGINE OIL LEVEL Check oil dipstick, add oil, if needed, to raise level to full mark.	
6	●					AIR CLEANER Check element to insure it's clean, wash if needed in warm soapy water (after six washings, have organizational maintenance replace it).	Element is missing or damaged.
7		●				HORN Check horn by pressing button	
8		●				BRAKES Check that normal break pressure stops truck.	Service brake won't stop truck.
9		●				STEERING Check that truck steers free & easy.	Steering sticks or truck is hard to steer.

OPERATOR/CREW PREVENTIVE MAINTENANCE CHECKS AND SERVICES

B-BEFORE D-DURING A-AFTER W-WEEKLY M-MONTHLY

ITEM NO	INTERVAL					ITEM TO BE INSPECTED PROCEDURE: CHECK FOR AND HAVE REPAIRED, FILLED OR ADJUSTED AS NEEDED	EQUIPMENT IS NOT READY AVAILABLE IF:
	B	D	A	W	M		
10		●				ACCELERATOR Check that truck goes smoothly from slow to fast speed.	Pedal sticks.
11		●				LIFT LEVER Check that lifting and lowering is smooth in acceleration and deceleration.	Lifting or lowering jerky or uncontrollable.
12		●				TILT LEVER Check that forward and backward tilt is smooth and immediate.	Tilt does not operate.
13		●				SIDE SHIFT LEVER Check that shift works.	
14		●				LIGHTS Check that lights are working and properly aligned.	
15						INSTRUMENT PANEL Check for abnormal operating readings.	
		●				(1) Oil pressure gauge - Less than five psi at idle speed.	
		●				(2) Ammeter - Registers discharge when engine is operated at above idle speed.	Readings on gauges fall within specified ranges.

OPERATOR/CREW PREVENTIVE MAINTENANCE CHECKS AND SERVICES

B-BEFORE D-DURING A-AFTER W-WEEKLY M-MONTHLY

ITEM NO	INTERVAL					ITEM TO BE INSPECTED PROCEDURE: CHECK FOR AND HAVE REPAIRED, FILLED OR ADJUSTED AS NEEDED	EQUIPMENT IS NOT READY/ AVAILABLE IF:
	B	D	A	W	M		
		●				(3) Water temperature - Registers in red portion of gauge.	
		●				(4) Transmission temperature gauge - Registers 210°F or above.	
16				●		STEER AXLE STOPS	
						Check to insure they are present and not damaged.	
17				●		BATTERY	
40						Inspect for electrolyte level, add distilled water if required (reference TM 9-6140-200-12).	Battery cracked or discharged.
18				●		RADIATOR ENGINE COMPARTMENT	
						Inspect/clean air passages.	
19					●	BREATHER CAP ENGINE	
						Remove and clean.	
20					●	FAN BELT	
						Inspect for looseness or frayed condition.	Belt slips.

ORGANIZATIONAL PREVENTIVE MAINTENANCE CHECKS AND SERVICES

Q-Quarterly S-Semiannually A-Annually B-Biennially H-Hours M-Miles

ITEM NO	INTERVAL						ITEM TO BE INSPECTED PROCEDURE: Check for and have repaired, filled, or adjusted as needed
	Q	S	A	B	H	MI	
							NOTE: Adjust engine valve clearance after first 50 hours of operation. NOTE Perform Operator/Crew PMCS prior to or in conjunction with organizational PMCS if: a. There is a delay between the daily operation of the equipment and the organizational PMCS. b. Regular operator is not assisting/participating.
1							MAST ASSEMBLY a. Lubricate sliding and roller contact surfaces. b. Clean and inspect lift chains for bent or cracked links. Check adjustment and lubricate. c. Tighten top mast bolt to 135 ft. lbs. torque.
2							BATTERY Inspect/service electrolyte level and charge as required. Check that cables are secure and clean (reference TM 9-6140-200-12).
3					100		ENGINE **a. Drain engine oil, replace oil filter** and refill with five quarts (see Appendix E).

ORGANIZATIONAL PREVENTIVE MAINTENANCE CHECKS AND SERVICES

Q-Quarterly S-Semiannually A-Annually B-Biennially H-Hours M-Miles

ITEM NO	INTERVAL						ITEM TO BE INSPECTED PROCEDURE: Check for and have repaired, filled, or adjusted as needed
	Q	S	A	B	H	MI	
							b. Check fan belt tension - 1/2" to 3/4" deflection at point halfway between fan and alternator pulleys with about 10 lbs. applied force.
4							TRANSMISSION Check fluid level in transmission on dipstick located under the trap door in the floor plate. Engine must be running. Add transmission fluid to bring level up to full mark on dipstick.
5					100		DRIVE AXLE Check and clean breather located on housing.
6							FUEL TANK Clean fuel strainer.
7					100		DIFFERENTIAL Check oil level with truck on flat surface, add oil to bring level up to inspection plug.
8					200		HYDRAULIC OIL FILTER Replace. Check for leaks.
9					200		TRANSMISSION OIL FILTER Replace. Check for leaks.

ORGANIZATIONAL PREVENTIVE MAINTENANCE CHECKS AND SERVICES

Q-Quarterly S-Semiannually A-Annually B-Biennially H-Hours M-Miles

ITEM NO	INTERVAL						ITEM TO BE INSPECTED PROCEDURE: Check for and have repaired, filled, or adjusted as needed
	Q	S	A	B	H	MI	
10					200		HYDRAULIC OIL RESERVOIR Replace breather.
11					500		ELECTRICAL SYSTEM Check tightness of terminals, wires, cables, and electrical components.
12					500		HOSES, TUBES, AND FITTINGS Inspect, replace or have replaced, if necessary, correct any leaks that are evident.
13					500		WHEELS a. Clean and lubricate steer wheel bearings. b. Inspect and replace as necessary the brake shoes, turn cylinder if required (not to exceed .100).
14					500		BRAKE MASTER CYLINDER Check fluid level and add if necessary to bring level within 3/8" to 1/2" from top of reservoir.
15					500		BRAKE PEDAL Adjust, pedal should not reach floorboard when depressed with 1/2" free play.

ORGANIZATIONAL PREVENTIVE MAINTENANCE CHECKS AND SERVICES

Q-Quartarly S-Semiannually A-Annually B-Biennially H-Hours M-Miles

ITEM NO	INTERVAL						ITEM TO BE INSPECTED PROCEDURE: Check for and have repaired, filled, or adjusted as needed
	Q	S	A	B	H	MI	
16					500		MAST ASSEMBLY a. Check for side play of fork carriage and check chain adjustment if it is not level. b. Remove lift chains, clean and inspect for wear and broken or cracked links. Repair, install, adjust, and lubricate.
17					500		ENGINE a. Replace distributor points. b. Replace spark plugs. c. Remove and clean PCV valve.
18					500		PARKING BRAKE Check and adjust as necessary.
19					500		CONTROL VALVE Check linkage.
20					500		UNIVERSAL JOINT Check and adjust if necessary.

ORGANIZATIONAL PREVENTIVE MAINTENANCE CHECKS AND SERVICES

Q-Quarterly S-Semiannually A-Annually B-Biennially H-Hours M-Miles

ITEM NO	INTERVAL						ITEM TO BE INSPECTED PROCEDURE: Check for and have repaired, filled, or adjusted as needed
	Q	S	A	B	H	MI	
21					1000		COOLING SYSTEM Drain fluid, flush and refill.
22					1000		TRANSMISSION Drain fluid and refill.
23					1000		DIFFERENTIAL Drain oil and refill.
24					1000		HYDRAULIC OIL RESERVOIR Drain hydraulic oil, flush and refill.

APPENDIX H

PRESCRIBED LOAD LIST/AUTHORIZED STOCKAGE LIST

ITEM: Truck, Forklift, 4,000 Lb., Gas Powered S.R.T.

CONTRACT NO.: DSA-700-78-C-8339

CONTRACTOR: Allis-Chalmers, Matteson, Illinois

QUANTITY: 90 each

PREVIOUS PROCUREMENTS:

Contractor	Quantity	Year
Motec	284	FY62
Minn-Moline	223	FY60
Baker	52	FY64
Towmotor	779	FY70
Baker	432	FY71
Towmotor	59	FY71
Baker	173	FY70
Allis-Chalmers	180	FY76

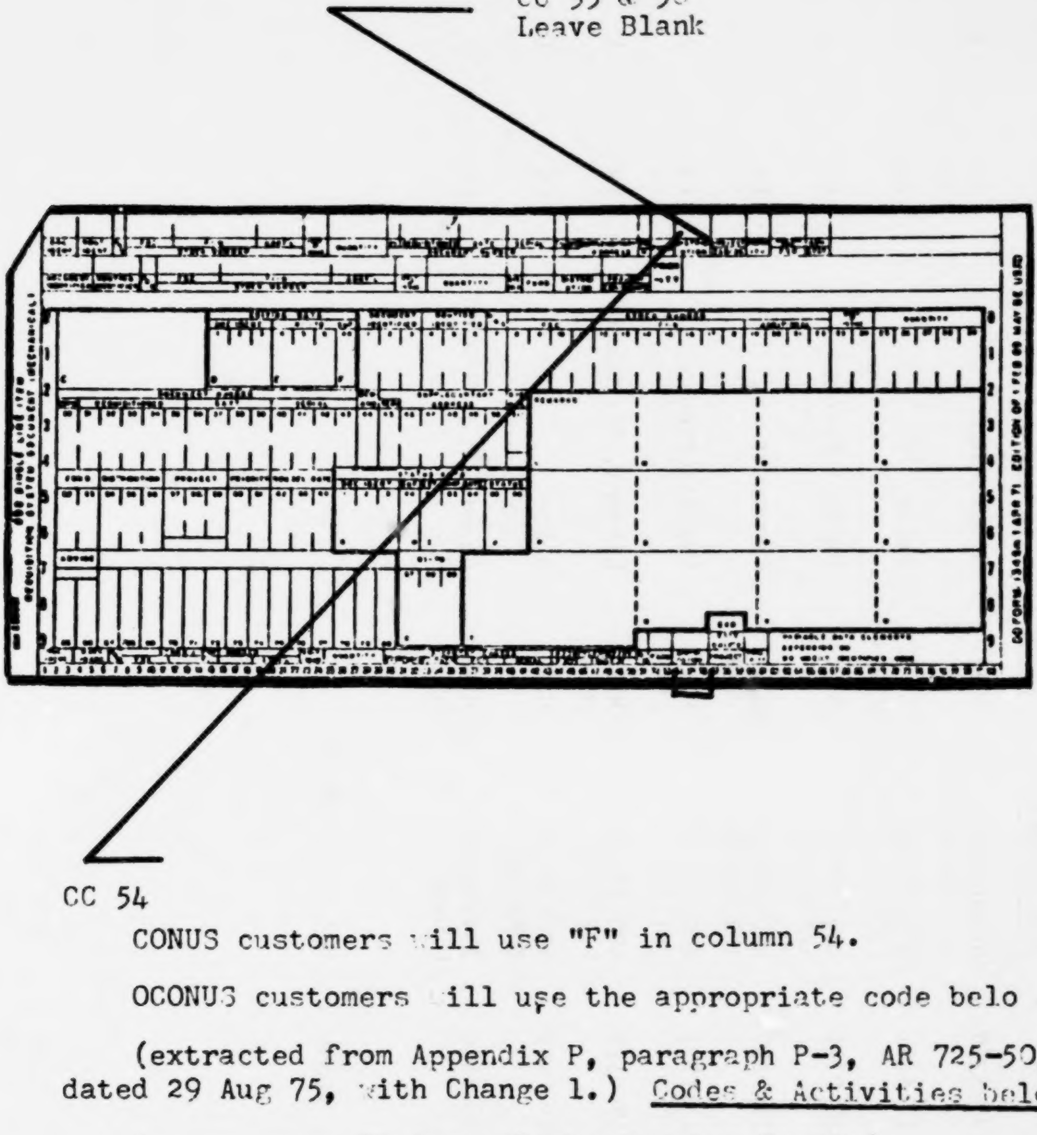
MGR	NSN	PART NUMBER	FSCM	PART DESCRIPTION	U.M.	PLL 1-5	ASL 1-5	UNIT PRICE
S9C		4511629-0 6664270	30612 81321	Filter, Trans	Ea	1	1	1.03
S9C		4910775-8 F600L03750	30612 02978	Filter, Lube Oil	Ea	4	10	1.76
S9C	2910-00-394-2585	74906096 M3331-5110	30612 92863	Filter, Element, Hyd.	Ea	1	2	1.15
S9C	3030-00-605-2959	4856615-2 5-9308	30612 81300	Belt, Fan	Ea	1	2	3.12

MGR	NSN	PART NUMBER	FSCM	PART DESCRIPTION	U.M.	PLL 1-5	ASL 1-5	UNIT PRICE
S9C	2920-00-293-5219	4910105-8 SP207S00016RD	30612 02978	Spark Plug	Ea	4	16	.44
S9C	2940-01-017-6772	4908523-6 F401F0273	30612 02978	Valve, PCV	Ea	1	1	1.05
S9C	2920-00-888-9761	4909100-2 1BP2040LA	30612	Contact Points	Ea	1	3	.42
S9E	5910-00-521-5159	4909101-0 1BB2042SS1	30612 19728	Condenser	Ea	1	3	.39
S9C	2920-01-018-1931	4909102-8 1BT1111	30612 19728	Cap Distributor	Ea	0	1	13.30
S9C	2920-01-019-4119	4907794-3 P12-2510	30612 18265	Element, Air Cleaner	Ea	1	6	9.10
S9C	2920-00-041-2543	4909103-6 1GP1016D	30612	Rotor	Ea	1	3	.95
S9I	5330-00-736-8476	3046862-3 P10-1872	30612 18265	Gasket, Air Cleaner	Ea	1	6	.68

NOTE: All PLL/ASL Items are SMR Coded PAOZZ

APPENDIX I

Distribution Codes



CC 55 & 56
Leave Blank

CC 54

CONUS customers will use "F" in column 54.

OCONUS customers will use the appropriate code below.

(extracted from Appendix P, paragraph P-3, AR 725-50, dated 29 Aug 75, with Change 1.) Codes & Activities below:

A ———————— US Army Alaska Support Command
Fort Richardson, Alaska
APO Seattle, WA 98749

B ———————— USA International Logistics Center
New Cumberland Army Depot
New Cumberland, PA 17070 (For transceiver and mail)

D ———————— US Army Security Agency
Supply and Maintenance Center
Vint Hill Farms Station
Warrenton, VA 22186

E ———————— US Army Aviation Systems Command
P.O. Box 209
St. Louis, MO 63166

*F ———————— US Army Logistics Control Activity
Presidio of San Francisco, CA 94129

H ———————— US Army Support Command, Hawaii
(USASCH)
Schofield Barracks, Hawaii
APO San Francisco 96557

I ———————— US Army Troop Support Command
4300 Goodfellow Boulevard
St. Louis, MO 63120

J ———————— US Army Supply and Maintenance
Activity, Sagami (USASMAS)
Sagami, Japan
APO San Francisco 96343

K ———————— US Army Inventory Management Center
Camp Henery, Taegu, Korea
APO San Francisco 96212

L ———————— US Army Missile Command
Redstone Arsenal, AL 35809

M ———————— Reserved (DA)

O ———————— Reserved (DA)

P ———————— US Army Electronics Command
ATTN: Director of Materiel Management
Fort Monmouth, NJ 07703

Q ———————— US Army Materiel Command, Europe
APO New York 09052

R ———————— Director for Supply Operations
US Army Base Command, Okinawa
APO San Francisco 96248

S ---------- US Army Armament Command
Rock Island, IL 61202

T ---------- Reserved (DA)

*U ---------- US Army Medical Materiel Agency
Fredrick, MD 21701

V ---------- Reserved (DA)

W ---------- Reserved (DA)

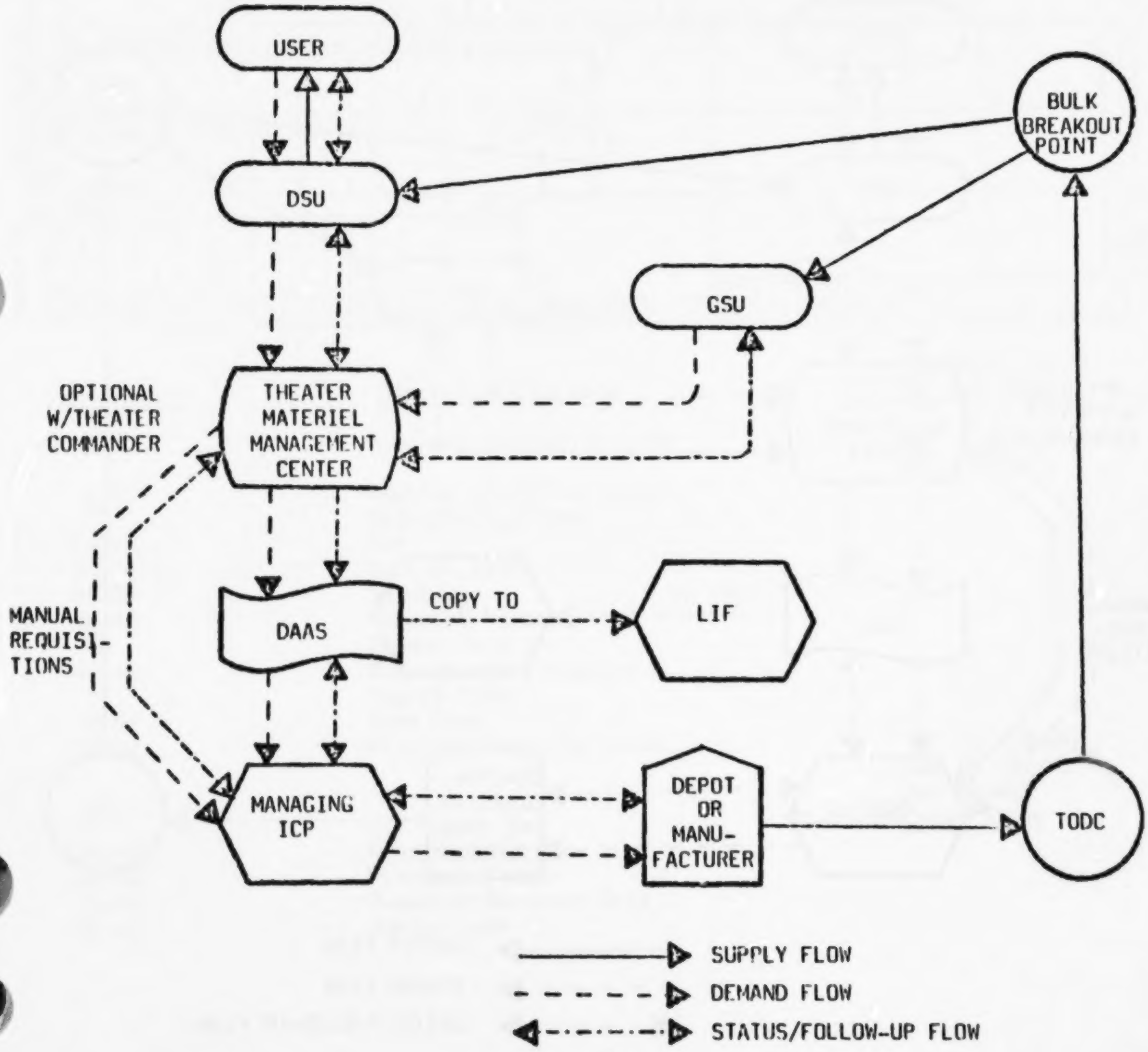
X ---------- Reserved (DA)

Y ---------- US Army Tank-Automotive Commands
Warren, MI 48090

Z ---------- Directorate for Inventory Control
US Army Medical Materiel Center, Europe
Einseidlerhof, Germany
APO New York 09227

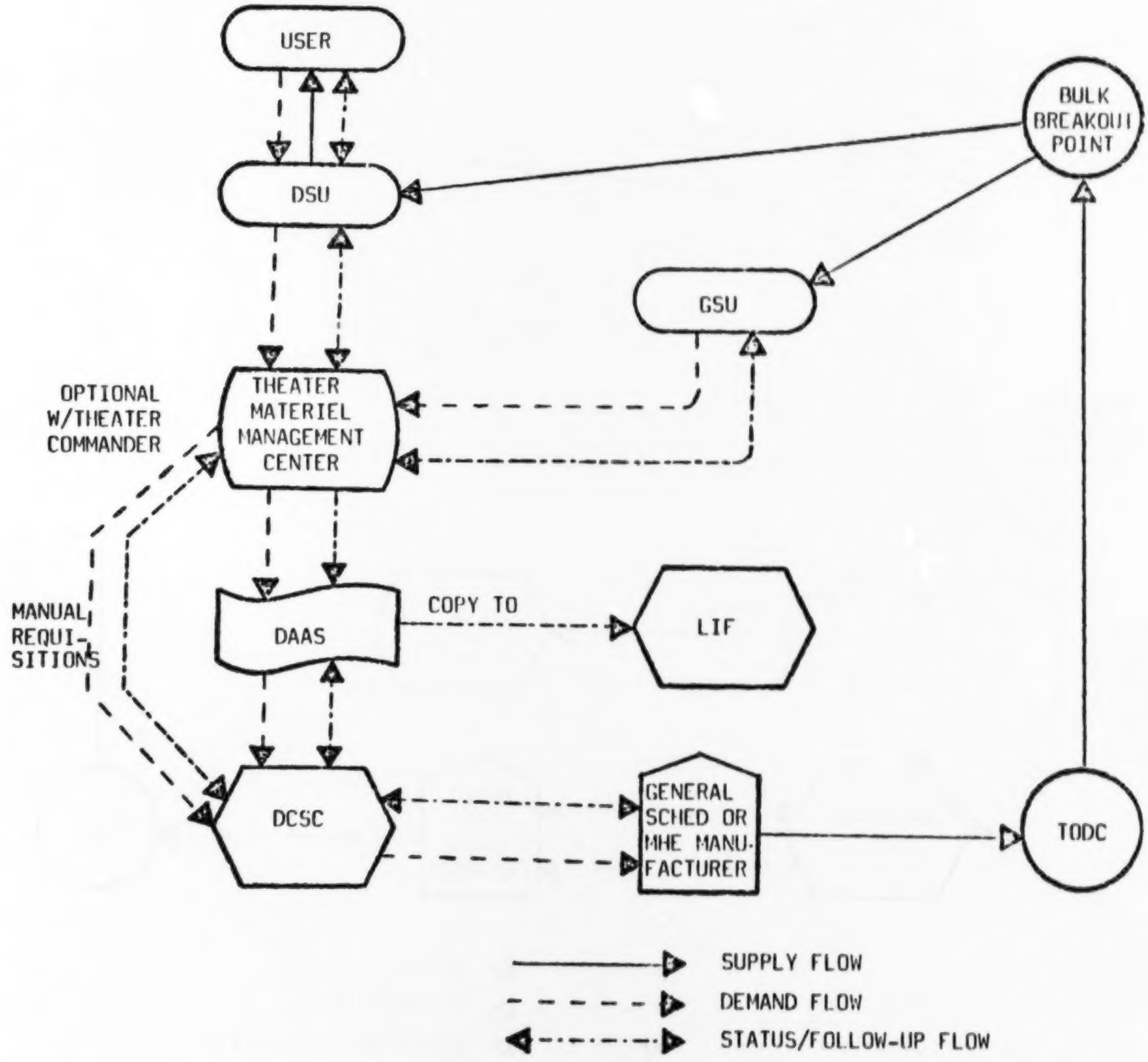
APPENDIX J

FLOW OF REQUISITIONS AND MATERIEL
CHE/MHE PARTS (NSN)


USER
DSU
BULK BREAKOUT POINT
GSU
OPTIONAL W/THEATER COMMANDER
THEATER MATERIEL MANAGEMENT CENTER
MANUAL REQUISITIONS
DAAS
COPY TO
LIF
MANAGING ICP
DEPOT OR MANUFACTURER
TODC
SUPPLY FLOW
DEMAND FLOW
STATUS/FOLLOW-UP FLOW

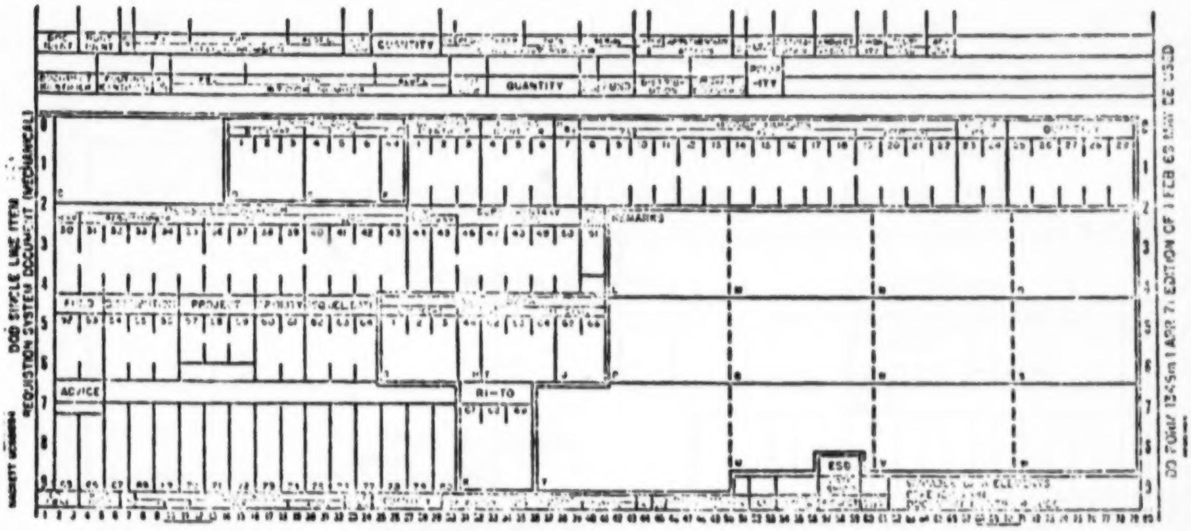
APPENDIX K

FLOW OF REQUISITIONS AND MATERIEL
CHE/MHE PARTS (NON-NSN)


USER
DSU
BULK BREAKOUT POINT
GSU
OPTIONAL W/THEATER COMMANDER
THEATER MATERIEL MANAGEMENT CENTER
MANUAL REQUISITIONS
DAAS
COPY TO
LIF
DCSC
GENERAL SCHED OR MHE MANUFACTURER
TODC
SUPPLY FLOW
DEMAND FLOW
STATUS/FOLLOW-UP FLOW

APPENDIX L

SAMPLE FORMAT - MILSTRIP REQUISITION FOR CHE/MHE (NSN)



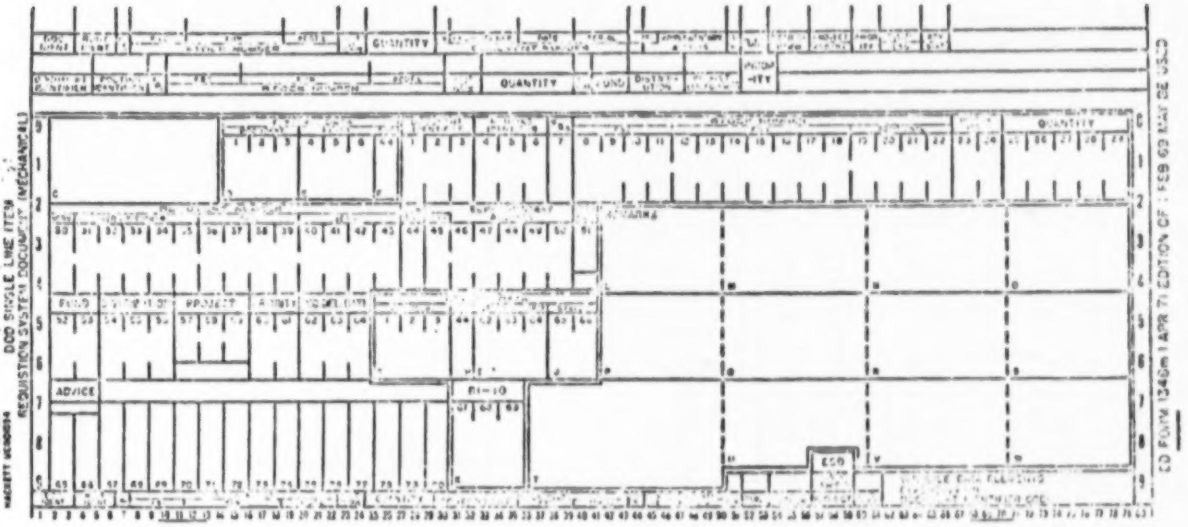
DOD SINGLE LINE ITEM REQUISITION SYSTEM DOCUMENT (MECHANICAL)

DD FORM 1348m 1 APR 71 EDITION OF 1 FEB 63 MAY BE USED

QUANTITY
REMARKS
ADVICE
RI-TO
ESD

Card Column	Description of Data	Mandatory Entry For CHE/MHE
1-3	Document Identifier Code	A0A - CONUS A01 - OCONUS
4-6	Routing Identifier Code	
7	Media/Status Code	
8-22	NSN	
23-24	Unit of Issue	
25-29	Quantity	
30-43	Document Number	
44	Demand Code	
45-50	Supplementary Address	
51	Signal Code	
52-53	Fund Code	
54-56	Distribution Code CC-54	"F" for CONUS; See AR 725-50 for OCONUS CC-55-56-Leave Blank
57-59	Project Code	
60-61	Priority Code	
62-64	Required Delivery Date	
65-66	Advice Code	

SAMPLE FORMAT - MILSTRIP REQUISITION FOR CHE/MHE (NON-NSN)


QUANTITY
ADVICE
DD FORM 1348m 1 APR 71 EDITION OF 1 FEB 69 MAY BE USED
DOD SINGLE LINE ITEM REQUISITION SYSTEM DOCUMENT (MECHANICAL)

Card Column	Description of Data	Mandatory Entry for CHE/MHE
1-3	Document Identifier Code	A0B - CONUS A02 - OCONUS
4-6	Routing Identifier Code	Always S9C
7	Media/Status Code	
8-22	FSCM and Part Number	
23-24	Unit of Issue	
25-29	Quantity	
30-43	Document Number	
44	Demand Code	
45-50	Supplementary Address	
51	Signal Code	
52-53	Fund Code	
54-56	Distribution Code CC-54	"F" for CONUS; See AR 725-50 for OCONUS
	CC-55-56 -	Leave Blank
57-59	Project Code	CONUS - BGX OCONUS - JZM
60-61	Priority Code	
62-64	Required Delivery Data	
65-66	Advice Code	

INSTRUCTIONS

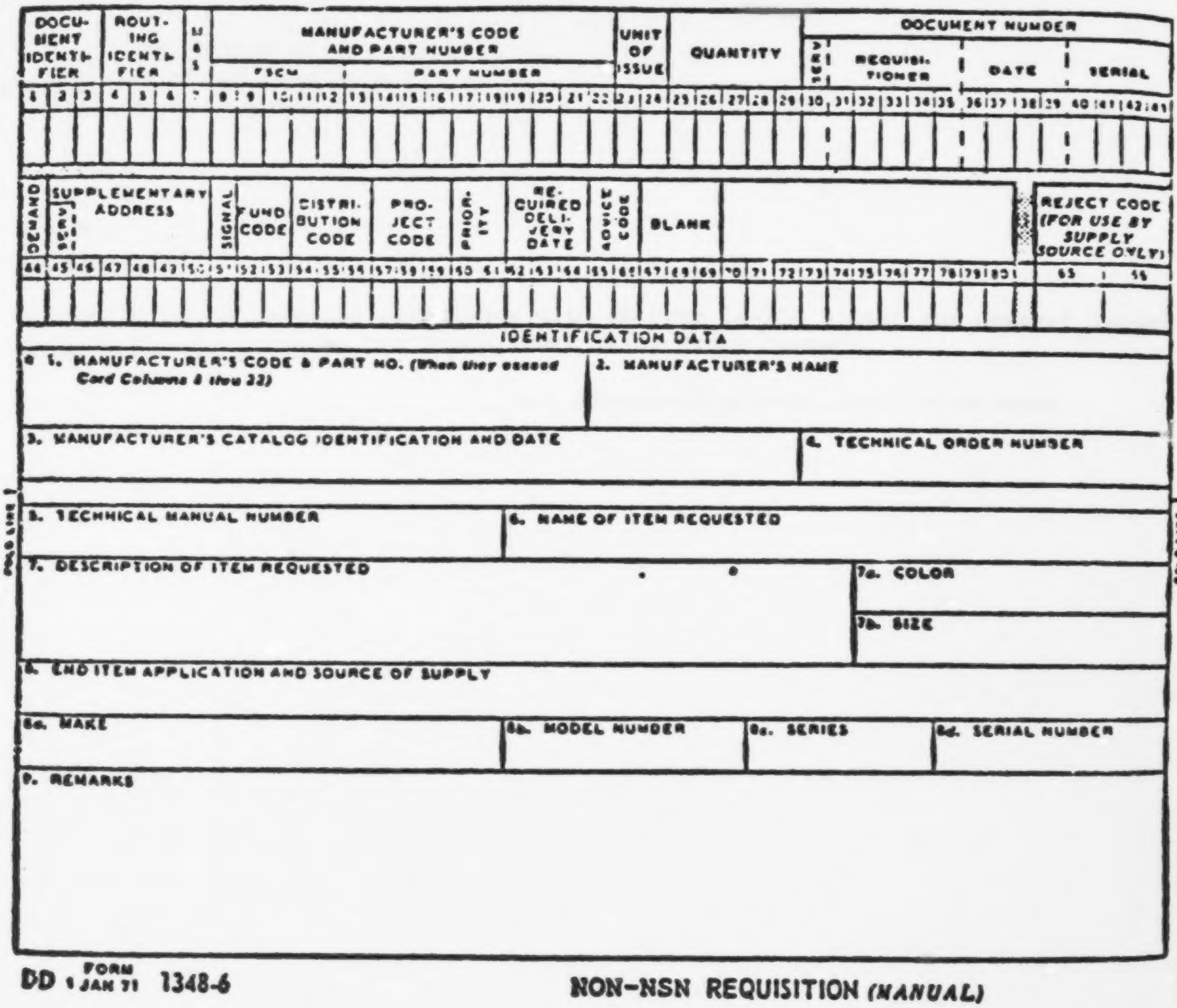
This form will only be used in those cases where the manufacturer's code and part number exceed the spaces allocated in card columns 8 - 22 of the requisition.

CARD COLUMN	DESCRIPTION OF DATA	MANDATORY ENTRY FOR CHE/MHE
1-3	Document Identifier Code	A0E - CONUS A05 - OVERSEAS
4-6	Routing Identifier Code	Always S9C
7	Media Status Code	
8-22	FSCM and Part Number	Leave Blank Enter in Block 1 Under Identification Data
23-24	Unit of Issue	
25-29	Quantity	
30-43	Document Number	
44	Demand Code	
45-50	Supplementary Address	
51	Signal Code	
52-53	Fund Code	
54-56	Distribution Code CC 54	"F" for CONUS. (See AR 725-50 for OVERSEAS.)
	CC-55-56 -	Leave Blank
57-59	Project Code	CONUS - BGX OCONUS - JZM
60-61	Priority Code	
62-64	Required Delivery Date	
65-66	Advice Code	
67-80		Blank

IDENTIFICATION DATA - Lower half of DD Form 1348-6, complete blocks 1 thru 9.

Card Column	Description of Data	Mandatory Entry, CHE/MHE
67-69	Blank	
70	Identification Code Applicable to Entry in cc 71-80 A - Technical Order or Technical Manual B - End Item Identification C - Noun Description D - Drawing or Specification No.	
71-80	Reference Identification	Identification of Reference Specified in cc 70

SAMPLE FORMAT - MILSTRIP REQUISITION FOR CHE/MHE (Non-NSN); (Manual)



DOCUMENT IDENTIFIER	ROUTING IDENTIFIER	M & S	MANUFACTURER'S CODE AND PART NUMBER: FSCM	MANUFACTURER'S CODE AND PART NUMBER: PART NUMBER	UNIT OF ISSUE	QUANTITY	DOCUMENT NUMBER: SERV	DOCUMENT NUMBER: REQUISITIONER	DOCUMENT NUMBER: DATE	DOCUMENT NUMBER: SERIAL
1 2 3	4 5 6	7	8 9 10 11 12	13 14 15 16 17 18 19 20 21 22	23 24	25 26 27 28 29	30	31 32 33 34 35	36 37 38 39	40 41 42 43

DEMAND	SUPPLEMENTARY ADDRESS: SERV	SUPPLEMENTARY ADDRESS	SIGNAL	FUND CODE	DISTRIBUTION CODE	PROJECT CODE	PRIORITY	REQUIRED DELIVERY DATE	ADVICE CODE	BLANK		REJECT CODE (FOR USE BY SUPPLY SOURCE ONLY)
44	45	46 47 48 49 50	51	52 53	54 55 56	57 58 59	60 61	62 63 64	65 66	67 68 69	70 71 72 73 74 75 76 77 78 79 80	65 66

IDENTIFICATION DATA

1. MANUFACTURER'S CODE & PART NO. *(When they exceed Card Columns 8 thru 22)*
2. MANUFACTURER'S NAME
3. MANUFACTURER'S CATALOG IDENTIFICATION AND DATE
4. TECHNICAL ORDER NUMBER
5. TECHNICAL MANUAL NUMBER
6. NAME OF ITEM REQUESTED
7. DESCRIPTION OF ITEM REQUESTED

7a. COLOR

7b. SIZE

8. END ITEM APPLICATION AND SOURCE OF SUPPLY

8a. MAKE

8b. MODEL NUMBER

8c. SERIES

8d. SERIAL NUMBER

9. REMARKS

FOLD LINE

FOLD LINE

DD FORM 1 JAN 71 1348-6

NON-NSN REQUISITION *(MANUAL)*

By Order of the Secretary of the Army:

E. C. MEYER
General, United States Army
Chief of Staff

Official:

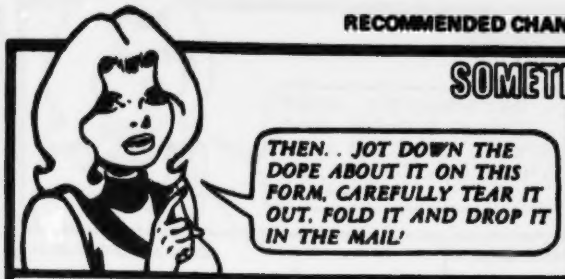
J. C. PENNINGTON
Major General, United States Army
The Adjutant General

Distribution:

To be distributed in accordance with DA Form 12-25A Direct and General Support maintenance requirements for Truck, Fork Lift, Rough Terrain.

☆ U.S. GOVERNMENT PRINTING OFFICE : 1990 0 - 261-872 (20848)

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS


THEN. . JOT DOWN THE DOPE ABOUT IT ON THIS FORM, CAREFULLY TEAR IT OUT, FOLD IT AND DROP IT IN THE MAIL!

SOMETHING WRONG WITH THIS PUBLICATION?

FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)
Your mailing address

DATE SENT
Date you filled out this form

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM 10-3930-639-14&P	1 May 1981	Forklift Truck, 4,000 LB CAP, Model ACC 45 PS

BE EXACT. . .PIN-POINT WHERE IT IS

PAGE NO.	PARA-GRAPH	FIGURE NO.	TABLE NO	IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:
75		183		Change illustration. Reason: Tube end shown assembled on wrong side of lever cam.
110		57		Fig 57, item 3 has the wrong NSN. The NSN shown here is not listed in the AMDF or the MCRL. Please give us the correct NSN and P/N.

SAMPLE

PRINTED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER	SIGN HERE:
SP4 John Smith, 484-2001	SP4 John Smith

TEAR ALONG PERFORATED LINE

DA FORM 1 JUL 79 2028-2

PREVIOUS EDITIONS ARE OBSOLETE.

P.S.--IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR RECOMMENDATION MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS.

REVERSE OF DA FORM 2028-2

FILL IN YOUR
UNIT'S ADDRESS

FOLD BACK

DEPARTMENT OF THE ARMY

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE $300

POSTAGE AND FEES PAID
DEPARTMENT OF THE ARMY
DOD 314

Commander
US Army Tank-Automotive Command
ATTN: DRSTA-MBS
Warren, MI 48090

TEAR ALONG PERFORATED LINE

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS

THEN. . JOT DOWN THE DOPE ABOUT IT ON THIS FORM, CAREFULLY TEAR IT OUT, FOLD IT AND DROP IT IN THE MAIL!

SOMETHING WRONG WITH THIS PUBLICATION?

FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)

DATE SENT

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM 10-3930-639-14&P	1 May 1981	Forklift Truck, 4,000 LB CAP, Model ACC 45 PS

BE EXACT. . .PIN-POINT WHERE IT IS				IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:
PAGE NO	PARA-GRAPH	FIGURE NO.	TABLE NO	

PRINTED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER	SIGN HERE:

TEAR ALONG PERFORATED LINE

DA FORM 1 JUL 79 2028-2

PREVIOUS EDITIONS ARE OBSOLETE.

P.S.--IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR RECOMMENDATION MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS.

REVERSE OF DA FORM 2028-2

FILL IN YOUR
UNIT'S ADDRESS

FOLD BACK

TEAR ALONG PERFORATED LINE

DEPARTMENT OF THE ARMY

____

____

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE $300

POSTAGE AND FEES PAID
DEPARTMENT OF THE ARMY
DOD 314

U.S. MAIL

Commander
US Army Tank-Automotive Command
ATTN: DRSTA-MBS
Warren, MI 48090

TEAR ALONG PERFORATED LINE

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS

SOMETHING WRONG WITH THIS PUBLICATION?

THEN. . JOT DOWN THE DOPE ABOUT IT ON THIS FORM, CAREFULLY TEAR IT OUT, FOLD IT AND DROP IT IN THE MAIL!

FROM (PRINT YOUR UNIT'S COMPLETE ADDRESS)

DATE SENT

PUBLICATION NUMBER TM 10-3930-639-14&P	PUBLICATION DATE 1 May 1981	PUBLICATION TITLE Forklift Truck, 4,000 Lb CAP, Model ACC 45 PS

BE EXACT. PIN-POINT WHERE IT IS

PAGE NO	PARA-GRAPH	FIGURE NO	TABLE NO	IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

PRINTED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER	SIGN HERE

DA FORM 1 JUL 79 2028-2

PREVIOUS EDITIONS ARE OBSOLETE.

P.S.--IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR RECOMMENDATION MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS

REVERSE OF DA FORM 2028-2

TEAR ALONG PERFORATED LINE

FILL IN YOUR
UNIT'S ADDRESS

FOLD BACK

DEPARTMENT OF THE ARMY

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE $300

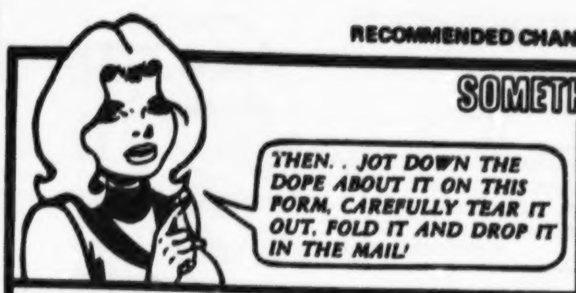
POSTAGE AND FEES PAID
DEPARTMENT OF THE ARMY
DOD 314

U.S. MAIL

Commander
US Army Tank-Automotive Command
ATTN: DRSTA-MBS
Warren, MI 48090

TEAR ALONG PERFORATED LINE

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS


THEN. . JOT DOWN THE DOPE ABOUT IT ON THIS FORM, CAREFULLY TEAR IT OUT, FOLD IT AND DROP IT IN THE MAIL!

SOMETHING WRONG WITH THIS PUBLICATION?

FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)

DATE SENT

PUBLICATION NUMBER TM 10-3930-639-14&P	PUBLICATION DATE 1 May 1981	PUBLICATION TITLE Forklift Truck, 4,000 LB CAP, Model ACC 45 PS

BE EXACT. . . PIN-POINT WHERE IT IS

PAGE NO.	PARA-GRAPH	FIGURE NO.	TABLE NO	IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

PRINTED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER	SIGN HERE:

DA FORM 1 JUL 79 2028-2

PREVIOUS EDITIONS ARE OBSOLETE.

P.S.—IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR RECOMMENDATION MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS.

REVERSE OF DA FORM 2028-2

FILL IN YOUR
UNIT'S ADDRESS

FOLD BACK

DEPARTMENT OF THE ARMY

____

____

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE $300

POSTAGE AND FEES PAID
DEPARTMENT OF THE ARMY
DOD 314

U.S.MAIL

TEAR ALONG PERFORATED LINE

Commander
US Army Tank-Automotive Command
ATTN: DRSTA-MBS
Warren, MI 48090

THE METRIC SYSTEM AND EQUIVALENTS

LINEAR MEASURE

1 Centimeter = 10 Millimeters = 0.01 Meters = 0.3937 Inches
1 Meter = 100 Centimeters = 1000 Millimeters = 39.37 inches
1 Kilometer = 1000 Meters = 0.621 Miles

WEIGHTS

1 Gram = 0.001 Kilograms = 1000 Milligrams = 0.035 Ounces
1 Kilogram = 1000 Grams = 2.2 Lb
1 Metric Ton = 1000 Kilograms = 1 Megagram = 1.1 Short Tons

LIQUID MEASURE

1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces
1 Liter = 1000 Milliliters = 33.82 Fluid Ounces

SQUARE MEASURE

1 Sq Centimeter = 100 Sq Millimeters = 0.155 Sq Inches
1 Sq Meter = 10,000 Sq Centimeters = 10.76 Sq Feet
1 Sq Kilometer = 1,000,000 Sq Meters = 0.386 Sq Miles

CUBIC MEASURE

1 Cu Centimeter = 1000 Cu Millimeters = 0.06 Cu Inches
1 Cu Meter = 1,000,000 Cu Centimeters = 35.31 Cu Feet

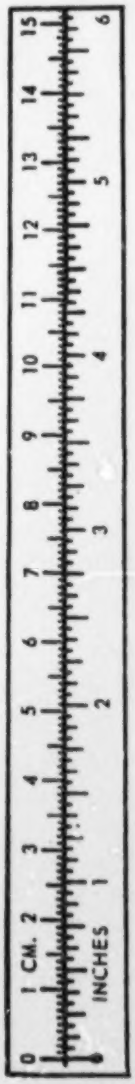
TEMPERATURE

$5.9\,({}^{0}F - 32) = {}^{0}C$
212^{0} Fahrenheit is equivalent to 100^{0} Celsius
90^{0} Fahrenheit is equivalent to 32.2^{0} Celsius
32^{0} Fahrenheit is equivalent to 0^{0} Celsius
$9/5\,C^{0} + 32 = F^{0}$

APPROXIMATE CONVERSION FACTORS

TO CHANGE	TO	MULTIPLY BY
Inches	Centimeters	2.540
Feet	Meters	0.305
Yards	Meters	0.914
Miles	Kilometers	1.609
Square Inches	Square Centimeters	6.451
Square Feet	Square Meters	0.093
Square Yards	Square Meters	0.836
Square Miles	Square Kilometers	2.590
Acres	Square Hectometers	0.405
Cubic Feet	Cubic Meters	0.028
Cubic Yards	Cubic Meters	0.765
Fluid Ounces	Milliliters	29.573
Pints	Liters	0.473
Quarts	Liters	0.946
Gallons	Liters	3.785
Ounces	Grams	28.349
Pounds	Kilograms	0.454
Short Tons	Metric Tons	0.907
Pound-Feet	Newton-Meters	1.356
Pounds per Square Inch	Kilopascals	6.895
Miles per Gallon	Kilometers per Liter	0.425
Miles per Hour	Kilometers per Hour	1.609

TO CHANGE	TO	MULTIPLY BY
Centimeters	Inches	0.394
Meters	Feet	3.280
Meters	Yards	1.094
Kilometers	Miles	0.621
Square Centimeters	Square Inches	0.155
Square Meters	Square Feet	10.764
Square Meters	Square Yards	1.196
Square Kilometers	Square Miles	0.386
Square Hectometers	Acres	2.471
Cubic Meters	Cubic Feet	35.315
Cubic Meters	Cubic Yards	1.308
Milliliters	Fluid Ounces	0.034
Liters	Pints	2.113
Liters	Quarts	1.057
Liters	Gallons	0.264
Grams	Ounces	0.035
Kilograms	Pounds	2.205
Metric Tons	Short Tons	1.102
Newton-Meters	Pound-Feet	0.738
Kilopascals	Pounds per Square Inch	0.145
Kilometers per Liter	Miles per Gallon	2.354
Kilometers per Hour	Miles per Hour	0.621



TA089991